ACORN USER

Number 3 October 1982 £1

Printing with the Epson, ZX and Seikosha

Moving graphics

Atom RGB circuits

The Beeb dials the world

Confessions of a TV producer

The BBC micro speaks

Broader horizons

'Whether your interests lie in business, educational, scientific, control or games applications, this system provides a possibility for expansion which is unparalleled in any other machine available at present,' comments Paul Beverley in the July 1982 edition of *Personal Computer World*.

The BBC Microcomputer can genuinely claim to satisfy the needs of novice and expert alike. It is a fast, powerful system generating high resolution colour graphics and which can synthesise music and speech. The keyboard uses a conventional layout and electric typewriter 'feel.'

You can connect directly* to cassette recorder, domestic television, video monitor. disc drives, printers (dot matrix and daisy wheel) and paddles. Interfaces include RS423, inter-operable with RS232C equipment, and Centronics. There is an 8-bit user port and 1MHz buffered extension bus for a direct link to Prestel and Teletext adaptors and many other expansion units. The Econet system allows numerous machines to share the use of expensive disc drives and printers.

BASIC is used, but plug-in ROM options will allow instant access to other high level languages (including Pascal, FORTH and LISP) and to word processing software.

A feature of the BBC Microcomputer which has attracted widespread interest is the Tube, a design registered by Acorn Computers. The Tube is unique to the BBC Microcomputer and greatly enhances the expandability of the system by providing, via a high speed data channel for the addition of a second processor. A 3MHz 6502 with 64K of RAM will double processing speed; a Z80 extension will make it fully CP/M** compatible.

The BBC Microcomputer is also at the heart of a massive computer education programme. The government has recommended it for use in both primary and secondary schools. The BBC Computer Literacy Project includes two series of television programmes on the use and applications of computers.

There are two versions of the computer. Model A, at £299, offers 16K of RAM and Model B at £399 has 32K of RAM.

For technical specification and order form, send stamped addressed envelope to P.O. Box 7, London W3 6XJ and for details of your nearest stockist ring 01-200 0200.

The BBC Microcomputer System

*Model A has a limited range of interfaces but can be upgraded to meet Model B specification.
**CP/M is a registered trade mark of Digital Research.
The BBC Microcomputer is designed, produced and distributed in the UK by Acorn Computers Limited.

Acorn User

The official magazine for users of the Acorn Atom, the BBC microcomputer system, and the Econet system, published by Addison-Wesley for Acorn Computers Limited.

- Authoritative information on all new Acorn products
- All the latest software reviewed, including the products of Acornsoft
- New peripheral equipment described and tested, including unofficial items
- Feature articles on the latest developments in microcomputing from the UK, Europe, North America the Far East, and Australasia
- Dealer and service features
- National and international user group news

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Jane Lake
Publisher
Stanley Malcolm
Typesetters and Designers
GMGraphics
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Phil Kanssen
Printed in Great Britain
by E.T. Heron & Co. Ltd.

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Dealer Deals Ltd
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01-930 1612

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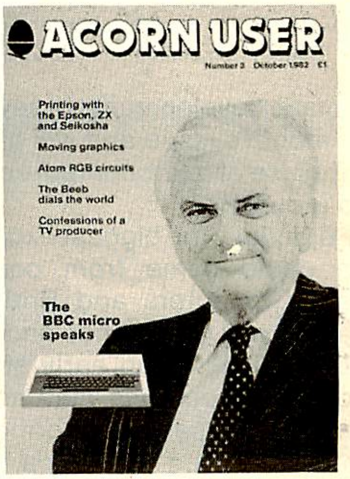


How to submit articles

You are welcome to submit articles to the Editor of *Acorn User* for publication. *Acorn User* cannot undertake to return them unless a stamped addressed envelope is enclosed. Articles should be typed or computer written. Black and white photographs or transparencies are also appreciated. If submitting programs please send a cassette or disc. Listings should not contain more than 39 characters per line for ease or reproduction. Payment is £50 per page or pro rata. Please indicate if you have submitted your article elsewhere. Send articles, reviews and information to: The Editor, *Acorn User*, 53 Bedford Square, London WC1B 3DZ.

See next month's *Acorn User* for:

● Speeding up graphics ● Your technical queries answered ● Special features of MOS 1.0 ● Machine code printing ● The Spectrum revealed ● Hardware news ● Progams for schools

The world opens up to your computer

Dramatic developments in several areas dominate this month's issue and will have a marked effect on the use of microcomputers in the home, office and industry.

Potentially the biggest expansion of the micro's role could come from cooperation between Acorn Computers and British Telecom on an international conference and information system.

This is still at an early stage but the implications for electronic mail and accessing mainframe databases are enormous. These services are already used in America, but Britain has yet to take up the challenge.

On a national level, BT's Prestel service has announced its own telesoftware project to match the BBC's. This could provide a much needed boost for the viewdata service which has been hampered by the cost of adapted TV sets – and the cost of using telephone lines. So far Prestel has attracted only about 18,000 users compared to 500,000 teletext TV sets for Oracle and Ceefax.

Home computers can now take in Prestel with an adaptor costing less than £100 – a big saving on £500 to £1000 for Prestel TVs.

The BBC's telesoftware service on Ceefax is now looking for an editor. Whoever takes the job must ensure programs are bug-free and idiot-proof as Ceefax takes full responsibility for its information. Good luck to him!

Back to Acorn Computers and more down-to-earth matters. Complaints about Acorn and Vector have come in to *Acorn User*. These have been passed on and are being dealt with.

Chris Curry has issued clarification on the machine operating system and reassured owners about making simple modifications to Acorn products after talks with *Acorn User*.

Peter Goater, the head of Vector, is confident his service has improved. But can four BBC micros make such a vast improvement? Time and his telephone answering system will tell.

Now for the good news – the Electron, voice synthetiser and paddles should be with us by December. The voice ROM could herald a revival for the English language – as opposed to American, Japanese and Dalek variants. Nobody seems sure whether this is the first English synthetiser – no doubt someone can let us know.

After all the flak thrown about by Atom users on the first issue, things seem to have died down. Are you all happy?

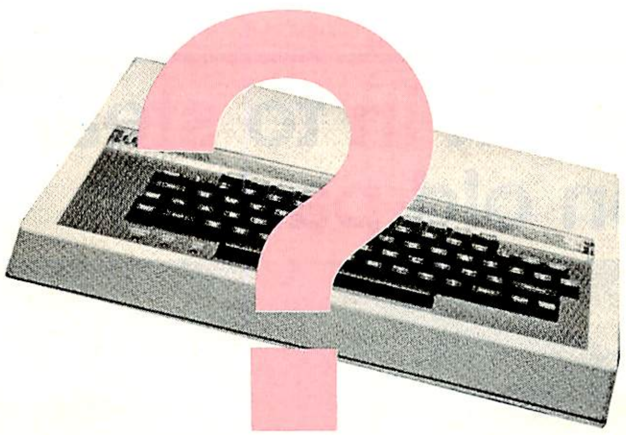
As for this issue, David Allen's article on what happened behind the scenes during the first BBC computer series makes delightful reading. That's what being in the forefront of technology is all about.

For long-suffering spouses and friends of people waiting for the BBC micro, a familiar tale is told by Mrs Ronnie Rowsell. Her baptism into computer technology has been a warm one. Things can only get better, and at least her sense of humour has not been dulled.

Finally, keep the letters flooding in. If something doesn't please you, let me know, otherwise you have only yourself to blame.

Electron to use add-on modules

Curry says ULA determining release of new £150 micro



THE Electron is alive and kicking, and it's on schedule for a launch by the end of the year, says Acorn director Chris Curry.

The £150 micro will support the BBC machine's graphics modes – except teletext, with access to 32k RAM. All keys are programmable with single-key entry.

It pioneers a module system and will be expandable to almost the full BBC specification. Modules clip securely on to the back of the micro with fixing screws. These will provide Econet, a general purpose Centronics, RS232 interface, and Prestel with mode 7 in software.

They can be added in tandem, and fix onto the back of each other.

The cream - coloured Electron casing feels thicker and stronger than that of the BBC micro, but is smaller: 330 x 160 x 50mm. The modules are the same depth and width as the computer and about 60mm long.

A sound capability is provided, but only one channel, and the processor will run slower than the Beeb.

Four sockets on the left side of the casing provide inputs for UHF and PAL, composite video or colour monitor, cassette and RGB colour monitor. Eight colours are supported plus flashing.

On the right, a single socket is for the power supply. A separate transformer is provided for the Electron to meet stringent British safety regulations.

Chris Curry says the machine will be available before the end of the year.

'I would like to be able to promise before Christmas,' said Curry. 'Finalising the massive ULA is the dominant factor.'

Enthusiasm for the machine is barely restrained at Acorn, but the company is waiting until things are right to avoid the production difficulties which plagued the BBC machine.

Hermann Hauser, Acorn's technical director, has pushed aside comparisons with the Spectrum. He describes Sinclair's claims as arrogant, and says that the Electron is at the forefront of technology.

Acorn's design consultants are putting the finishing touches to the casing and once the ULA is underway, the show will be ready to roll.

So, patience is the name of the game. The November issue of *Acorn User* will carry further revelations.

Mysteries of cassette loading

PROBLEMS with loading cassettes have baffled even Acorn's experts. Some Welcome tapes have been found faulty, and problems are not helped because they are only recorded on one channel.

With some cassette recorders, an impedance mismatch may prevent low frequencies being recorded. On others, poor speed regulation may be the fault particularly at high baud rates, where the BBC micro requires ±12% at 1200 baud. Then, an unusual phase shift on the cassette could be the villain.

None of these problems should occur with Acorn's cassette, and the best results seem to be obtained with medium range units for about £25 to £35, which usually have a tape counter.

If varying the volume and tone do not work, dealers have been provided with diagnostic tools to solve the impedance and phase shift difficulties.

Guarantee valid after DIY upgrade

OPENING up the BBC micro casing will not automatically invalidate the six-month guarantee.

Acorn director Chris Curry says people can upgrade their model As as long as they do not interfere with other parts of the machine and use parts recommended by Acorn.

Also, the guarantee is extended by three months whenever the machine is altered by a dealer to take the additional interfaces within the initial six-month guarantee.

'Acorn User' in the shops

Acorn User will be available in newsagents from November. Distribution will be to branches of all the big chains and selected smaller shops.

Your local shop should also be able to handle regular orders.

Subscriptions will, of course, continue to be serviced in the normal way.

This issue will be available to subscribers and on sale at most dealers (see page 56).

Voice and paddles

GAMES paddles are now in production and set to be in the shops before Christmas. A pair costs £13 including VAT.

The speech synthesis ROM will be out in December and will cost about £25 (see pages 27-29). It can only be used with the 1.0 operating system.

BBC repeats

THE BBC's *Computer Programme* will be repeated on BBC 1, Sundays 12.35 to 1.00 pm from October 10 to December 12; again on Mondays 3.05 to 3.30 pm on BBC2 from October 11 to December 13.

Acorn clarifies MOS issue

CONFUSION still surrounds the 0.1 machine operating system in early BBC machines and whether it will be replaced free of charge or not. The answer is yes and no.

Those machines with 0.1 in EPROM will have the system exchanged free of charge for ROM 1.0, when these become available in six to eight weeks time. The exchange will also be free for users who buy any of the peripherals which need the 1.0 MOS.

Anyone else who wants the upgrade to 1.0 will have a nominal charge made by the dealer for the exchange. This should be about £10.

Chris Curry of Acorn stresses that the machine operating system is continually being developed – it has increased by 0.1 increments and now stands at about 1.2.

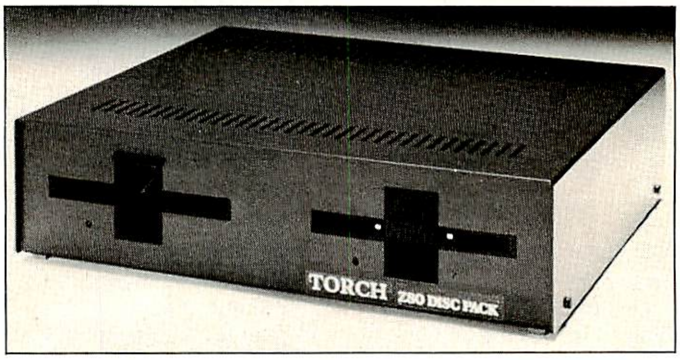
Some later machines have been supplied with 1.0 in EPROM, and Acorn will exchange these free.

Torch packs it in to steal a march on old partner

TORCH Computers, who once shared offices with Acorn, have launched a Z80 disc pack for the BBC micro.

For just under £1,000, buyers receive a Z80 processor board with 64k RAM, twin 400k drives and a CPN operating system which is claimed to run CP/M software.

The company demonstrated the £995 system at the PCW show.



Torch once had a corporate connection to Acorn, but the only link now is that Acorn provide BBC boards under contract to Torch.

This is the first major development from outside Acorn for the BBC system.

'I don't know what they have been doing,' said a Torch salesman at PCW. 'We developed the Z80 board in just a few weeks.

'We have stolen a march on Acorn.'

But Acorn seem to have expected it. 'This was bound to happen. It is up to us to compete,' said the company's spokesman.

Computer boost for Prestel

HOME *computers are providing a big opportunity for* British Telecom's Prestel system.

Television sets to receive the viewdata information service cost between £500 and £1000, but micros can link into Prestel with an adaptor costing under £100.

BT has attracted a paltry 3,000 domestic users to Prestel since 1979, but believes this could reach 100,000 by 1985 because of computers already in homes.

A 30,000 page database will be set up especially for computer owners, and software will be available for downloading. There will be a charge of between 50p and £5 for programs.

The scheme will start in January, and there are already more than 600,000 computers in homes.

Another idea is to supply adaptors free to households, with finance coming from the private sector.

Tutorials and courses

TWO meetings in December of interest to micro users:

■ Expert Systems Tutorial, December 20, London. Fee is £40. Details from Richard Forsyth, Maths Dept, Polytechnic of North London, Holloway Road, London N7 8DB.

■ Development of new Teaching and Learning Methodologies, December 12-17, Bristol. Sessions on the BBC micro, December 12, 14. Fee is £82.50 including accommodation. Details from Registrar, Further Education Staff College, Coombe Lodge, Blagdon, Bristol BS18 6RG.

Teachers in limbo

TEACHERS should by now have received information on the Government's micro subsidy scheme.

But many are frustrated by the lack of software, and are unable to write it themselves.

One enterprising primary teacher has taught two mothers to program by setting up a series of recipes, or routines, which they can tag onto their software.

These recipes perform simple tasks such as asking the child to write their name, say 'Well done', or just play a tune.

The Microelectronics Education Programme has commissioned software to support the Government scheme. The address is: MEP, Cheviot House, Coach Lane Campus, Newcastle NE7 7XA.

A network of training co-ordinators has been set up by the MEP.

Other sources of help are Muse and MAPE (see user groups), and the ITMA Project, College of St Mark and St John, Plymouth PL6 8BH.

When writing to these organisations, please include a large sae.

Acorn User will pass on information as it comes in. There will also be a major software review in December.

Cassette filing system

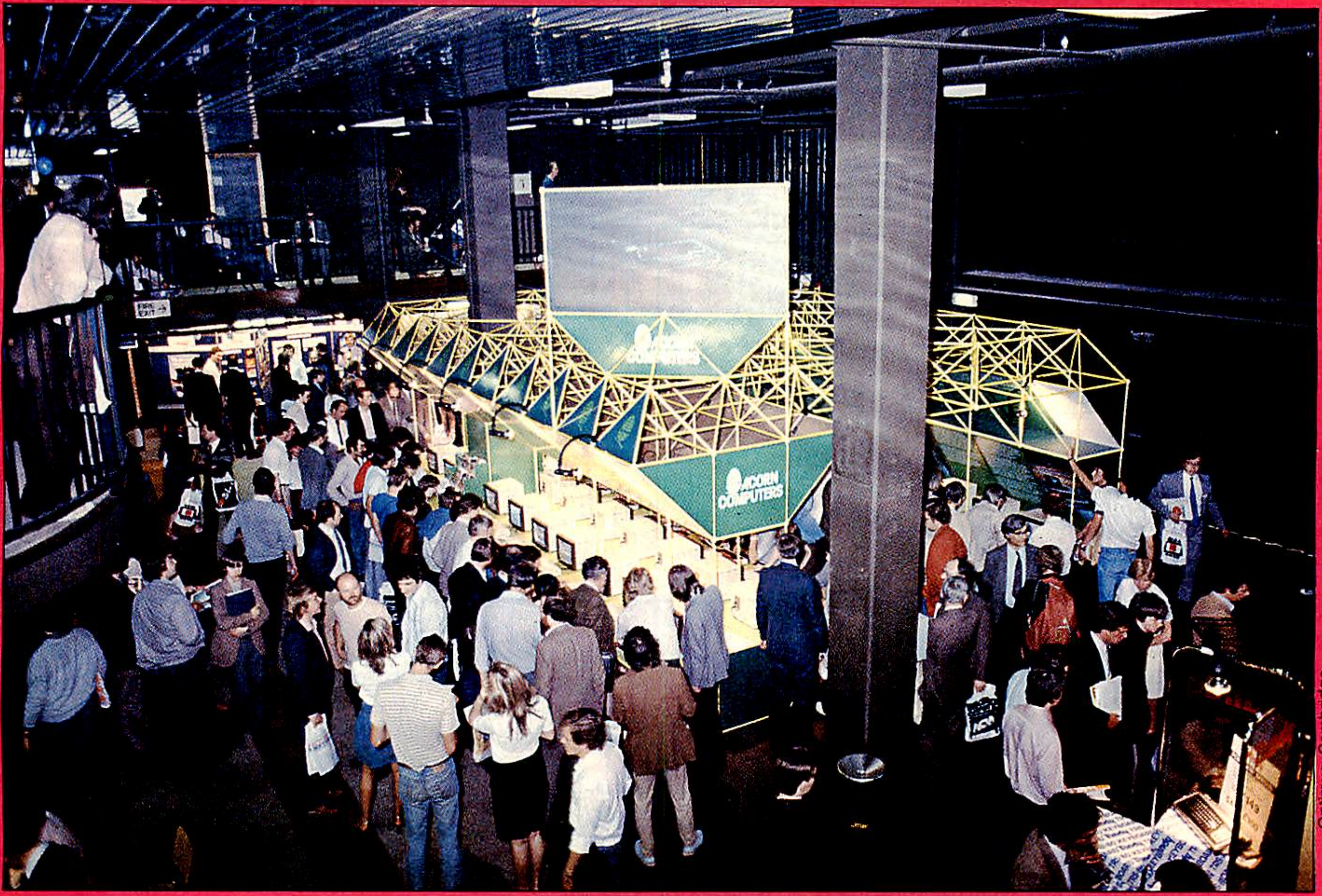
SEVERAL readers have written in to check the cassette filing system program given in the letters section of September's *Acorn User*.

The vertical symbol in the program on line 9 should be ¦, which is found on the top right of the keyboard.

Also, it doesn't matter that the square bracket symbol appears as an arrow.

Next month's letters section will include a large number of technical enquiries.

MR WOOD wrote in to inform *Acorn User* of a change in address. Fine so far. But his new address is 'Little Acorn'. Is someone having us on, or have we really changed his life?'



Optimus, Cambridge

Mobbed. . . the Acorn stand, host to a possible 53,000 people

Bodies, bodies everywhere. . .

WHY do computer shows always coincide with roasting weather, and take place in venues with inadequate air conditioning systems?

The PCW show at the Barbican was a classic example, and would have scared off all but the most enthusiastic exhibition goer.

But computer buffs – from six to sixty – are nothing if not enthusiastic, and walls of people, seven-feet-high ceilings and queues for everything were minor irritations.

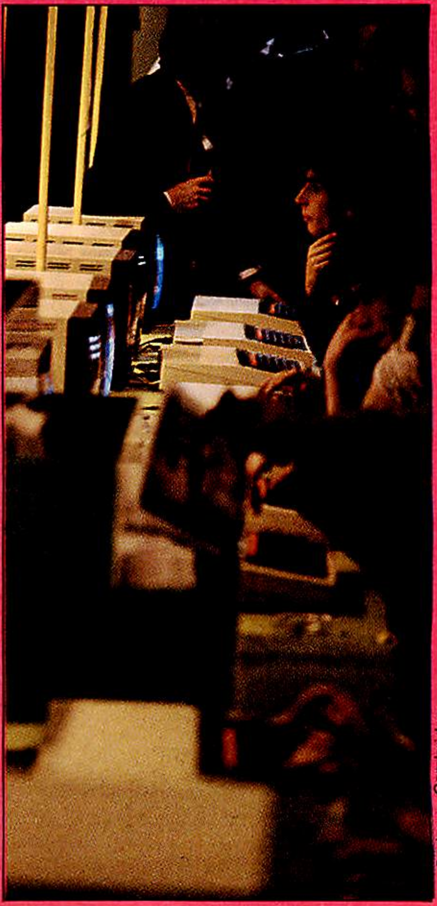
Some people suffered however – mainly mums burdened with carrier bags crammed full of leaflets, badges and magazines collected by eager tots. The kids did the dragging, poor mum did the lugging.

Those who couldn't stand the pace sat on the stairs and comforted themselves with drinks and sticky buns – they needed the energy.

Something else which needed the energy was the Acorn stand on Thursday afternoon – the power went down twice. Sensitive circuit breakers was what the overworked electrician put it down to.

These were minor hitches and the stands were a joy to sit at and grab computers. Lasers, robots and endless razzamatazz all played their part.

Electron-seekers went away disappointed, but consoled by flash pictures of BBC micros. And never mind, there's always Compec in November. And it can't get any hotter!



Optimus, Cambridge

Concentration. . . once you got to a machine you made the most of it

Vector moves in the right direction

VECTOR Marketing has replied to criticism of the new marketing set-up for the BBC microcomputer system.

Managing director Peter Goater now has seven operators for his six phone lines, and is using BBC model Bs as enquiry terminals onto Vector's main Alpha computer.

Letters are now being sent out to check whether people have received their orders. If your order has not yet been filled, return the letter to Vector. If it has, then tear it up. If there is no letter on the doormat, write to Vector at the address below and mark the envelope: Urgent order progress.

Model A is available on three weeks delivery
Model A plus Econet interface: production started in September.
Model B: orders should all have been despatched by September 25.
Thereafter four week delivery.
Model B Econet: production has started.
Model B plus disc interfaces: should all be despatched by September 25
Thereafter four week delivery.
Model B plus disc plus Econet: production now underway.
Second processor – **6502:** production to commence in November (provisional).
Second processor – **Z80:** production to commence in November (provisional).
Second processor – **16-bit:** production to commence in Feb 1983 (provisional).
Single drive (100) is available on four weeks delivery.
Dual disc drive (800): production underway.
Teletext receiver: production to commence in October.
Prestel receiver: production scheduled for spring 1983.
12" monochrome monitor is available on three weeks delivery.
14" colour monitor is available on three weeks delivery.
Cassette recorder is on four weeks delivery, existing orders to be in line with computer despatches.
Games paddles per pair: now being despatched.

Goater admits the switchover did not go as well as he had hoped. 'There were even problems with the fire extinguishers,' he claimed.

But there are better signs: 'There are peaks and troughs in calls, and yesterday there were no calls waiting at times.'

If you have not received a new *User Guide*, write to Vector Marketing, Denington Industrial Estate, Wellingborough, Northants NN8 2RL. Tel: (0933) 79300.

● If your BBC micro does not work, take it to your Acorn dealer, or send it to Retail Control Systems, Gresham House, Twickenham Rd, Feltham, Middx, TW13 6HA.
Tel: 01-898 4761

'Lousy delivery'

SOME of our readers are none too happy with Acorn Computers and Vector Marketing. 'Good on initial sales literature, lousy on delivery,' was how one long-suffering would-be user described the organisation.

Any complaints, queries, writs or letter bombs the Editor receives are being passed on, with suitable comments, to the relevant company.

This pressure should result in remedial action

There is, however, no truth in rumours of a *Would-be Acorn User* magazine being launched – to our knowledge anyway.

Program puzzler

This is the first of a regular series of puzzles based on the BBC Microcomputer.

Write a function FNSQ (X) that will give the square of its argument X.

For example:

FNSQ(6) should be 36.

Now for the catch: the function should not refer to any other variables, except X, and must not contain "*", "/", or "^" signs.

The solution makes use of the relationship:

$x^2 = (x-1)^2 + 2x - 1$

to define x^2 recursively in terms of $(x - 1)^2$. The definition is then:

DEF FNSQ(X) IF X = 0 = 0 ELSE = FNSQ(ABS(X − 1)) + X + 1

Software chips in

SOME Acornsoft programs will not work on expanded BBC model As unless the 6522 VIA chip is fitted in position IC69.

The cassettes in question include *Monsters*, *Snapper* and *Defender*, so far. All these have all been written for the BBC micro model B.

This chip is fitted in model Bs, and the modification will apply to other 32k Acornsoft products.

Your local Acorn dealer should be able to supply and fit this part. (For dealer list see page 56.)

Acorns steal the flower show

FLOWER power met its match last month when computer power muscled in on the Felsted village show in Essex.

Four BBC micros were linked by an Econet with two floppy discs to build up a datafile of entrants and entries for a flower show in the village hall.

The machines belonged to Felsted school who also provided the two software packages.

One entered details of the 81 proud growers and their 570 entries, while a second enabled browsers to look up their favourites and how they had done.

Sixth formers Dave Salter and Dave Bisset set up the system under the watchful eye of computer studies teacher Chris Dawkins.

David Salter, who took on the task as part of an 'O'-level project, said: 'It all went very well, although we did have someone behind the curtains debugging the system as it was being used.'

This, however, was a pilot scheme, as the system was only used as a back-up to the normal methods when it came to scoring. At the next show, in spring, there are plans to take over the scorecard system – and print labels for all the entrants.

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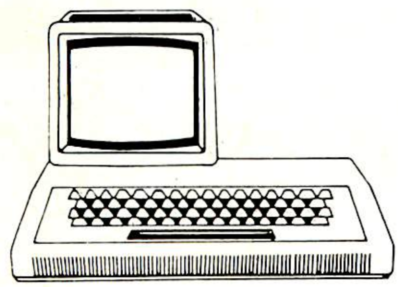

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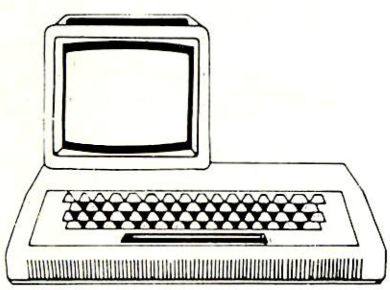

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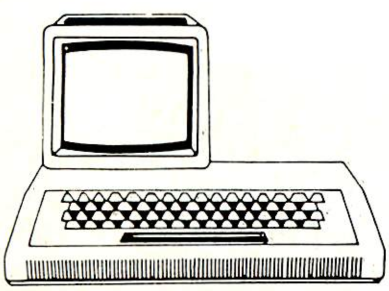

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The 'ice on the cake' is that, because the Cumana Drive has its own power supply, it can be used with many other Micros when connected via the appropriate cable. Cumana supply a Drive connecting cable which has a standard 34 way edge connector plus 34 way BBC connector **in the same cable length**. This allows the Cumana Drive to be connected to numerous makes of micro **without** the need to change connecting cable. **All at no extra cost!** And the **Japanese** manufactured disk drives are quiet and utterly dependable.

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A motley crew... Kelvin Jones (Snapper champ), Robin Mudge, Catherine Robbins, Mike Cocker (assistant producers), Fenella Sturt (production assistant), Steve Lowry (studio engineer). . . behind the Computer Programme

CONFESSIONS OF A TV PRODUCER

As Project Editor for the BBC Computer Literacy Project, I've been in the unique position of trying out the BBC microcomputer in its endless developing forms. This has been both a privilege and a form of masochism. A privilege because the machine is so good, and masochism because every time there was a change or a hitch, I and my colleagues suffered endless frustrations – through, for example, error messages or just nothing appearing on the screen when we tried to run software which had worked perfectly the day before.

A call to some long-suffering person at Acorn or one of the equally long suffering BBC engineers usually solved the problem – 'Didn't you know you were supposed to type PAGE=&400 then *FX 567342? (Thinks – you ignorant fool)'. All very educational for us since it forced us to try to understand the subtleties of the machine.

In September 1981, we started with bare circuit boards and not even a cassette filing system. The first television series was produced with the most amazing 'lash up' (I think that's the engineering jargon) – and programs were fed into the machine through a specially devised interface from one of Acorn's System 3 computers. This had a disc system, but it needed incantations and prayer to make it work.

Now it can be told that the BBC disc drive shown in the studio was a fake, we even had a member of the team to operate its red light on cue. And that database program on the front cover of the old user guide and on the front of the *BBC Computer Book* was really a specially generated page of Ceefax – you may have seen it if you happened to be watching page 703 of Ceefax between 2.30 and 4.30 on the afternoon of one hot August day last year. It was transmitted just for us and received in my sitting room where a photographer was waiting to take pictures of Chris Serle.

What's more, the computer Chris is shown using in that photograph was made of wood. Incidentally, our software writer, Ian Trackman, is hard at work producing a real home database program which will be shown in the next series and then will be on sale through BBC Publications.

But all this artifice was necessary to get the show on the road – and it is now trundling towards a second series *Making the Most of the Micro* – due for transmission next January. This time the computer is stable, reliable

(touch plastic) and a joy to use. We will be able to show much more of the complete system working for *real*, and we will be seeing other machines.

The micro is also being used behind the scenes at the BBC. In the production office we are using a model B, with an NEC printer and the BBC disc drive to field test one of the word processing packages which is being produced. This sits inside the machine as a chip plugged into one of the empty ROM sockets. The word processor has proved its worth and at last we can say to visitors that this is no 'Mickey Mouse' machine. It's got a serious purpose.

We type in programme outlines and then, as items get firmed-up these are enlarged to become final scripts. This saves the frustration of typing endless drafts and perhaps not knowing which is the latest one. It will be relatively easy to turn them into the long narrow strips of text that end up down the right hand side of the camera scripts we use in the studio (camera directions go down the left). The package also counts the number of words in a document (immensely tedious for us but a trivial problem for the computer). This can be useful in judging the length of a script, because roughly speaking a spoken commentary runs at 180 words per minute.

We also increasingly find that colleagues pop in to see what this new technology is all about. One such – the chap who signs our expenses – is hooked on games and is fast becoming the world champion at *Snake* and *Snapper*. He has to be prized off the machine after lunch. But others with more serious intentions are also coming in and beginning to see all kinds of potential for the computer – for example in producing interactive tutorial programs to accompany foreign language broadcasts.

'The disc drive was a fake'

Most recently we have been looking at the idea of linking the computer to the telephone, using an acoustic coupler, so that we can make use of the new electronic message service being offered by an offshoot of British Telecom (see page 20). Maybe I should keep quiet about this – *viewers might* start sending me electronic messages of complaint *instead* of writing letters. I wonder what the electronic equivalent of the waste-paper basket is?

And soon, we shall be able to receive the BBC telesoftware transmission – when we manage to get hold of one of the decoders being developed as part of the BBC system.

Finally, having the BBC machine around has enabled me to be utterly convinced that there is something in all this 'structured programming' business after all. I must confess that once I was hooked on GOTO, but now I am a reformed character. I can look a long program in the face and not be daunted by its potential complexity thanks to procedures. But my programs (with one 'm') are definitely not for transmission!

AT YOUR SERVICE

The Computer Referral Service is hardly a household name but already more than 6,000 people have used it. Most of them are now either on courses, active computer club members, or just at home beginning to find out what micros are all about.

The service has been their link to nearly 1,000 sources of help, information and advice. Anyone in the least bit interested in computers and computing can make use of it – especially beginners.

Although set up as part of the BBC Computer Literacy Project the service is run by the independent charity, Broadcasting Support Services. It has information on local courses, computer clubs, user groups, business advice and more.

But let's go back a year or so to the planning of the literacy project. The time was right for a major initiative to encourage everyone to find out more about computers. So a TV series about micros was conceived.

But if it was to be effective it needed some means of enabling people to get their hands on a micro.

And this is where the referral service came in. If enough colleges, clubs and enthusiasts were willing to help, the service could direct enquiries to them.

Hundreds of colleges and adult centres began working out what they could do to help and computer clubs began planning for a sudden surge in membership.

A major step forward was the assistance of the Amateur Computer Club, the British Computer Society and Computer Town UK. The BCS branches offered their help and nearly half the Computer Towns readily agreed to be referral points. This network meant most enquirers would be able to go along on club night and chat to enthusiasts before committing themselves. Five hundred colleges were running courses and workshops and the referral service was beginning to take shape.

The colleges had another role – they and polytechnics and universities were getting involved in giving advice and setting up courses for local businesses.

So all these were added as referral points along with in-service training agencies for teachers and those colleges running the 30-Hour Basic flexistudy course designed by the National Extension College. The Computer Referral Service was now ready to use.

Interested? All you have to do is send a large SAE to The Computer Referral Service, PO Box 7, London W3 6XJ

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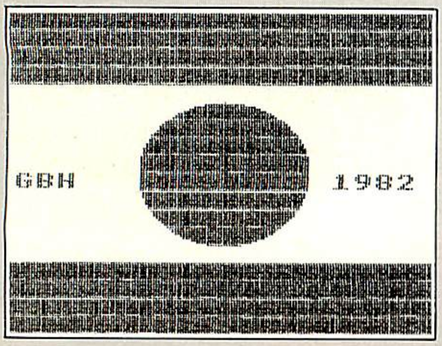
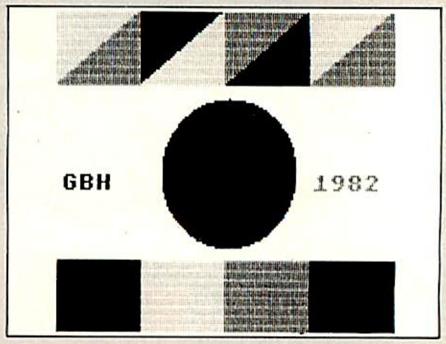


George Hill describes how to set up an Epson to print out your programs. Typical results are shown by these 'testcards'



EPSON MX80

These programs allow screen graphics to be dumped in less than 20 minutes using VDU drivers in BBC Basic. A shaded black and white picture is easily obtained with a standard Epson MX80 F/T.

The printer can be updated to a Type 2 printer, at the cost of a serial interface board and three EPROMs from Epson.

The eight dot wires of the printer head can be fired individually, according to whether the eight bits of the byte sent to the printer are on or off. The printhead is then moved on and another byte reproduced. The distance between dots can be halved in double density printing (figures 1 and 2).

At its simplest, the printer could fire a single dot if the point on the screen was on (colour > 0) and by scanning the screen using POINT (X,Y) to return the colour at X,Y we can produce a postcard .sized representation of the screen. Program 1 does this.

It is always correct to step four in the Y direction scan, as all graphics modes have 256 positions in that direction, despite the screen coordinates running from 0 to 1024. The step size in the X direction will vary with the mode. Mode 0 would use STEP 2, modes 1 and 4 use STEP 4, and modes 2 and 5 use STEP 8.

Program 1 produces an elliptical circle, which is a result of the video system, not the printer or your eyesight. This can be overcome, but at the cost of speed, and is not worth it in a two colour mode. To reproduce the four colours of modes 1, or 5, or the eight of mode 2, we must use a much more sophisticated approach, and define the patterns we send to the printer.

The line spacing must be set so adjacent lines of dots have no space between them, and the number of dots per line also has to be declared. This is done using escape codes obtained from the manual. FOR NEXT loops operate faster using integer variables. This is incorporated in program 2. You can try altering X,Y, and y to X%,Y%, and y% in program 1 to increase the speed.

In double density printing, the wires print overlapping dots as shown in figure 2. The total number of dots per line is 960. In mode 1 (320 by 256) we can use a three by

Program 1 gives single colour print – as in testcard top left

```
1ØØØ REM * * PRINTPIC * *
1Ø1Ø REM * Copyright G.B.Hill May 1982 *
1Ø2ØREM picture dump
1Ø3Ø REM single colour version
1Ø4ØREM ***variable declaration***
1Ø5Ø REM X,Y,y screen coordinates
1Ø6Ø REM S,C,P stores for screen
1Ø7ØREM set up printer
1Ø8ØPROCPRINTER
1Ø9Ø REM scan screen and send data
11ØØ PROCSCAN
111Ø REM finishing routine
112Ø PROCDONE
113Ø END
114Ø DEFPROCPRINTER
115Ø MOVE Ø,Ø :REM zero graphics cursor
116ØREM select RS423
117Ø *FX 5,2
118Ø REM 12ØØ baud
119Ø *FX 8,4
12ØØ VDU1,27,1,65,1,8
121Ø ENDPROC
122Ø DEFPROCSCAN
123Ø FOR Y=1Ø23 TO Ø STEP -32
124Ø VDU1,27,1,75,1,64,1,1
125Ø FOR X=Ø TO 1279 STEP 4
126Ø S=Ø.5:C=Ø:P=Ø
127Ø FOR y=28 TO Ø STEP -4
128Ø S=S*2 :REM sets bits
129Ø P=POINT(X,Y-y)
13ØØ IF P>=1 THEN C=C+S
131Ø NEXT y
132Ø VDU1,C
133Ø NEXT X
134Ø VDU1,1Ø :REM Linefeed
135Ø NEXT Y
136Ø ENDPROC
137Ø DEFPROCDONE
138Ø VDU1,27,1,5Ø :REM Normal linefeed
139Ø VDU 1,27,1,7Ø :REM Cancel condensed
14ØØ VDU4 : REM separate text cursor
141Ø PRINTTAB(1Ø);"Picture complete."
142Ø PRINT:PRINT:PRINT
143Ø PRINTTAB(16);"BYE"
144Ø PRINT:PRINT:PRINT:PRINT
145Ø ENDPROC
>
```

Program 2. Three-tone dump as in testcard opposite

```
1000 REM * * BITPRINT1 * * MODE 1 * *
1010  REM * Copyright G.B.Hill June 1982*
1020 REM Three tone picture dump
1030 REM ***variable declaration***
1040   REM X%,Y% screen coordinates
1050   REM P1,2,3,4 stores
1060  DIM C(4,3)
1070  C(0,1)=0:C(0,2)=0:C(0,3)=0
1080  C(1,1)=0:C(1,2)=1:C(1,3)=0
1090  C(2,1)=3:C(2,2)=0:C(2,3)=1
1100  C(3,1)=3:C(3,2)=3:C(3,3)=3
1110 REM set up printer
1120 PROCPRINTER
1130  REM scan screen and send data
1140  PROCSCAN
1150  REM finishing routine
1160   PROCDONE
1170  END
1180  DEFPROCPRINTER
1190  MOVE 0,0 :REM zero graphics cursor
1200  *FX 5,2
1210  REM select RS423
1220  *FX 8,4
1230  REM 1200 baud
1240  VDU2:PRINT:VDU3,1,10,1,10,1,10
1250  VDU1,27,1,65,1,8
1260  ENDPROC
1270  DEFPROCSCAN
1280  FOR Y%=1023 TO 0 STEP -16
1290 VDU1,27,1,76,1,192,1,3
1300 FOR X%=0 TO 1279 STEP 4
1310 P1=0:P2=0:P3=0:P4=0
1320 P1=POINT(X%,Y%-12)
1330 P2=POINT(X%,Y%-8)
1340 P3=POINT(X%,Y%-4)
1350 P4=POINT(X%,Y%)
1360 FOR J%=1 TO 3
1370 VDU1,(C(P1,J%)+4*C(P2,J%)+
      16*C(P3,J%)+64*C(P4,J%))
1380 NEXT
1390 NEXT
1400 VDU1,10 :REM Linefeed
1410 NEXT
1420 ENDPROC
1430  DEFPROCDONE
1440 VDU1,27,1,50 :REM Normal linefeed
1450 VDU 1,27,1,70 :REM Cancel
1460 VDU1,12,1.7 :REM formfeed and beep
1470 VDU5
1480  PLOT 4,400,224
1490  PRINT"Picture complete."
1500 PLOT 4,600,160
1510  PRINT"BYE"
1520   VDU4,26
1530  VDU31,0,31
1540 ENDPROC
```

two matrix to represent each point (figure 3), and in mode 2 (160 by 256) a six by two matrix (figure 4).

Program 2 (for mode 1) defines the patterns in arrays at the beginning of the program. There are four patterns for mode 1 on a three by two matrix, and the arrays are two dimensional, the first parameter referring to the colour, the second to the column of the dots. Scanning four elements at a time in the Y direction enables us to build up a succession of bytes to send to the printer via VDU1. The way these bytes are built up from the numbers in the arrays is shown in the example in figure 5.

So much for the theory, what about the practice? First, to avoid scrolling the picture off the top of the screen as you print it, you must define the text area in the graphics program. This can be anywhere, my own preference being for the bottom two or three lines of the screen. This is done using VDU28.

But beware: if any of the four parameters defining the text area are off the screen, normal scrolling occurs.

Finally, having stored the program numbered from 1000, proceed as follows:

- LOAD your graphics program.
- RENUMBER it to ensure that it ends before line 1000.
- PRINT~TOP–2 (this returns a hex number, "hexnumber", which you now use to merge the programs).
- *LOAD "BITPRINTn" hexnumber.
- Type OLD to reset the Basic pointers.
- Replace the END of your graphics program by GOTO 1000.
- Type RUN, wait and hope!

The November issue of *Acorn User* will give a listing for a seven-tone picture dump corresponding to mode 2.

Figure 1

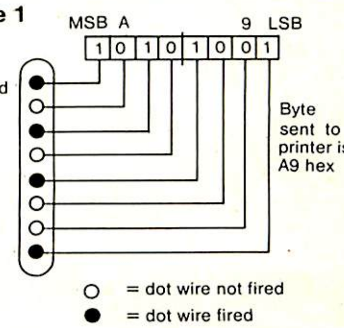


Figure 2

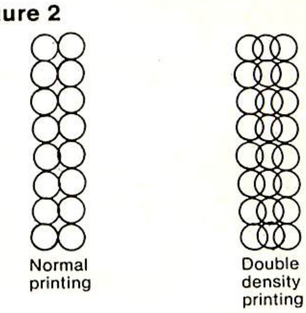


Figure 3

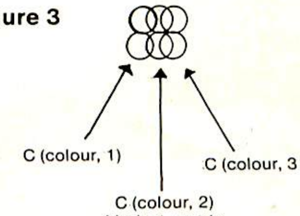
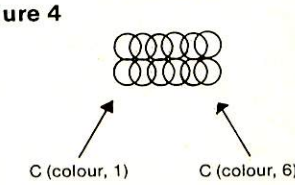


Figure 4



Mode 2 matrix

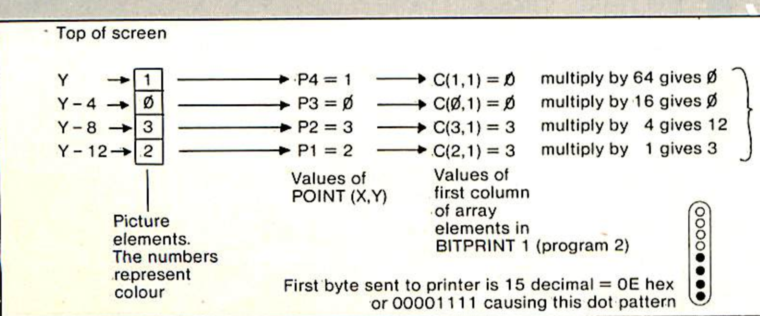


Figure 5

Andrew Cryer gives a simpler dot-for-dot copy on an Epson MX80 FT/2

DOT • FOR • DOT EPSON

This article describes a print routine written as a procedure so it can be appended to any program and will work in modes 0, 1, 2, 4 and 5. It translates each addressable point on the screen into one dot on the printer.

The TV image is displayed as a series of points which can be either light, dark or coloured. For an image which is either black or white the Basic function POINT (X,Y) gives a vlaue 1 or 0 depending on whether a particular screen position X,Y is light or dark. The procedure to produce a copy with the Epson uses this to sample positions on the screen. The procedure then translates what is on the screen into the codes required to drive the printer.

The Epson printer, when in the dot-addressable mode, allows each of the eight dot-producing wires in the printhead to be addressed separately. The procedure scans across the screen supplying the codes for the printhead as it prints across the page. For this the procedure needs to look at the screen and consider it as lines, each eight dots high. It then converts these screen lines into codes to be sent to the printer and thus produces a one-to-one image on the Epson.

Figure 1 shows an enlarged image for part of one of these screen lines. Each character in the screen line is composed of eight columns, each column being eight dots high, with each dot being either light or dark. The first column of this line is shown in figure 2.

Each column can be represented by a binary number of 1s and 0s – 1s corresponding to light areas and 0s to dark areas. The eight-bit binary number needs to be sent to the printer. Its most significant bit corresponds to the top of the column, and the least significant bit to the bottom. It is constructed by sensing in turn each of the eight bits and constructing the final binary number using:

code = code + 2∧J

where this line is repeated for J going from 0 to 7. (The initial value for 'code' is zero.)

This binary number is then sent to the printer by the use of a CHR$(1);CHR$(code). The CHR$(1) is interpreted as an instruction to send the next code directly to the printer only. Without this, the BBC micro will react unpredictably as it interprets codes less than 32 as requiring special action. Each eight-bit binary number needs to be sent to the printer, one at a time. This process continues until the whole screen has been interpreted.

Program 1 carries out this procedure which can be appended to the display-producing program using the method described on page 402 of the new *User Guide*.

The outer FOR . . . NEXT loop scans down the screen, one line of eight dots at a time. The next such loop scans along each line while the inner loop scans down any one column of dots to calculate the binary number. Line 10160 then sends this code to the printer.

When calling the procedure, values must be supplied for the two parameters. The first is the character height and the second is the character length. Both are measured in the same units as the screen coordinates. The table below gives the character heights and lengths for the different modes. By halving one or both of these, an enlarged image can be produced.

	Character height	Character length
Mode 0	32	16
Mode 1	32	32
Mode 2	32	64
Mode 4	32	32
Mode 5	32	64

To produce an identical image of what is on the screen in mode 4, PROCdump (32,32) is used. To produce an image twice the size in the same mode PROCdump (16,16) would be used. Further scalings could be applied using the same principle.

Figure 1. Enlarged screen image

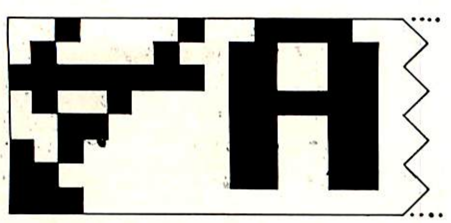


Figure 2. First column of image in figure 1

Program 1. Printer's orders

```
10000 DEF PROCdump(CH,CL)
10010 REM CH = Character height
10020 REM CL = Character length
10030 LOCAL Y,X,J,C,DA
10040 REM Set up printer
10050 DA=8*1280/CL
10060 VDU2,1,27,1,65,1,8,1,27,1,50,1,10
10070 FORY=1023TO0STEP-CH
10080   REM Set up printer for line
10090   VDU1,27,1,76,1,DA MOD256,1,DA DIV 256
10100   REM Print out line
10110   FOR X=0 TO 1279 STEP CL/8
10120     C=0
10130     FOR J=0TO7
10140       IFPOINT(X,Y-J*CH/8)<>0THENC=C+2^(7-J)
10150     NEXTJ
10160     PRINTCHR$1;CHR$(C);
10170   NEXTX
10180   PRINTCHR$1;CHR$10;
10190 NEXTY
10200 REM Turn printer off
10210 VDU3
10220 ENDPROC
```

SEIKOSHA GP100

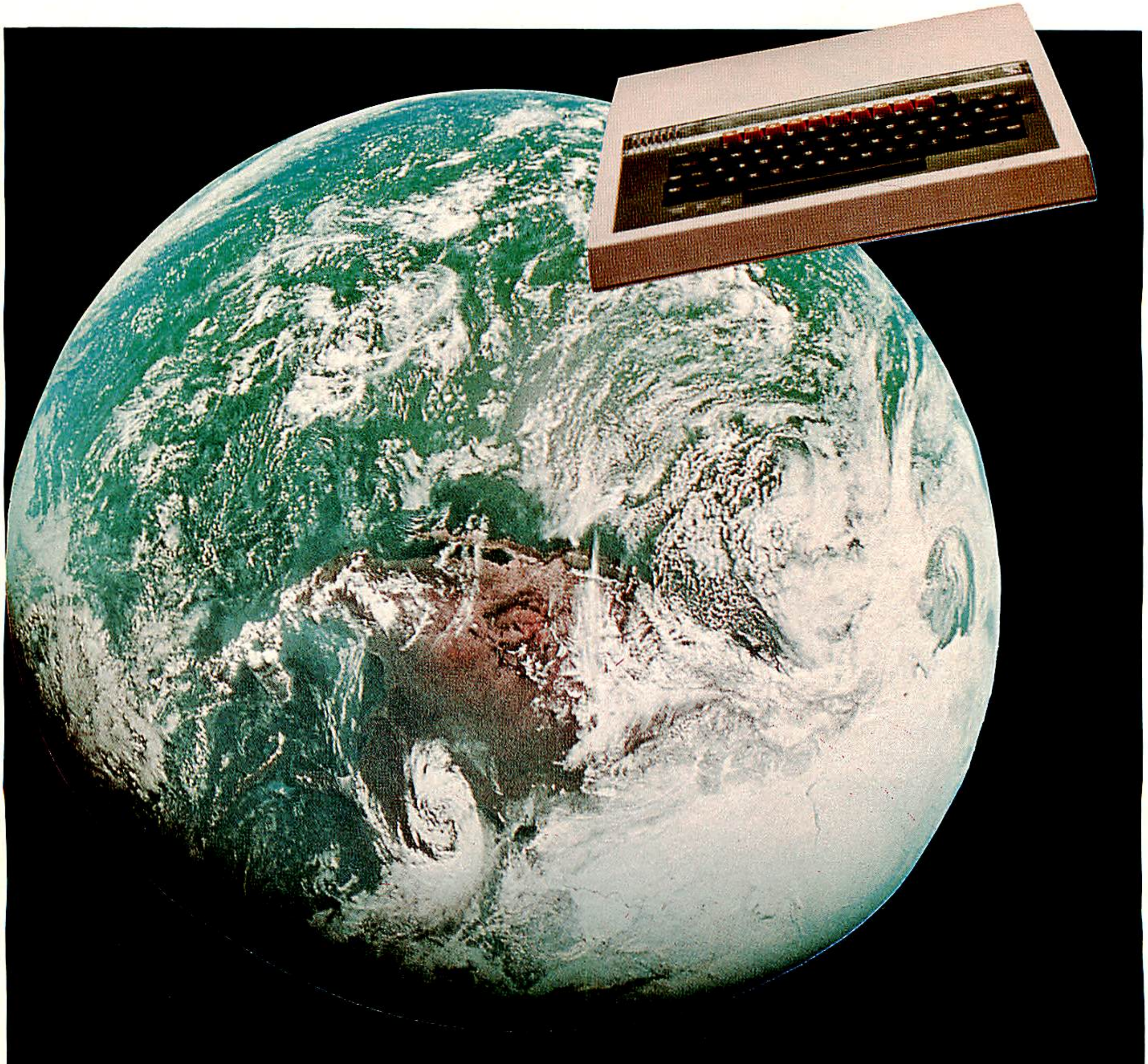
```
10 MODE1
20 LSB=0:MSB=0
30 FORA=0TO3STEP3:P%=HIMEM-400
40 OSWORD=&FFF1
50 OSWRCH=&FFE3
60 OSBYTE=&FFF4
70 [
80 OPTA
90 \    MARK SHAFFER
100 \    VERSION 1.3  (3/8/82)
110 .BEGIN
120 LDA #&87
130 JSR OSBYTE \FIND MODE
140 TYA
150 CMP #3
160 BEQ err
170 CMP #6
180 BEQ err
190 CMP #7
200 BEQ err
210 CMP #0
220 BNE noerr
230 .err
240 BRK
250 SEC
260 EOR &444F
270 EOR &3F \IS 'MODE?'
280 BRK
290 .noerr
300 LDA #1 \SEND NEXT CHAR TO
310 JSR OSWRCH \PRINTER
320 LDA #8
330 JSR OSWRCH \GRAPHICS MODE
340 LDA #1
350 JSR OSWRCH
360 LDA #10
370 JSR OSWRCH \SEND A LF
380 LDA #255
390 STA TABLE+2 \TOP OF SCREEN
400 STA SAV \COPY
410 LDA #3
420     STA TABLE+3
430 STA SAV1
440 .LOOP2
450 LDA #0 \LOAD TABLE WITH
460 STA TABLE \LEFT HAND EDGE
470 STA TABLE+1 \OF SCREEN
480 .LOOP3
490 LDA #0
500 STA &84 \RESET GRAPHS CHAR
510 LDA #7 \INITIALISE
520 STA &83 \LINE COUNT
530 .LOOP1
540 LDX #LSB \GET ADDRESS OF
550 LDY #MSB \TABLE
560 LDA #9 \ROUTINE #9
570 JSR OSWORD \READ PIXEL
580 LDA TABLE+4 \GET PIXEL
590 CMP #&FF \OFF SCREEN?
600 BNE OK \IF YES THEN SET
610 LDA #0 \BYTE TO 0
620 .OK
630 JSR MAKEB \SET A BIT
640 LDA TABLE+2 \GET Y POS
650 SEC
660 SBC #4 \GO DOWN 1 LINE
670 STA TABLE+2 \SAVE ADDRESS
680 LDA TABLE+3
690 SBC #0 \SUB CARRY FROM MSB
700 STA TABLE+3
710 DEC &83 \DEC LINE COUNT
720 LDA &83
730 CMP #0 \SEVEN LINES?
740 BNE LOOP1 \NO NEXT PIXEL
750 .PRIN
760 LDA #1
770 JSR OSWRCH
780 LDA &84 \GET GRAPHICS CHAR
790 ORA #128 \SET BIT 7
800 JSR OSWRCH ;WRITE GRAPHICS
810 LDA SAV \GET COPY
820 STA TABLE+2 \RESET LSB Y
830 LDA SAV1
840 STA TABLE+3 \RESET MSB Y
850LDA TABLE \GET X POS
860CLC
870ADC #4 \NEXT COLUMN
880STA TABLE
890LDA TABLE+1
900ADC #0 \ADD CARRY TO MSB
910STA TABLE+1
920 LDA TABLE \GET X POS LSB
930 CMP #0 \ZERO?
940 BNE NT64
950 LDA TABLE+1 \GET X POS MSB
960 CMP #5 \OFF RIGHT
970 BEQ NLINE \NEW LINE
980 .NT64
990JMP LOOP3
1000.NLINE
1010LDA SAV1 \GET X MSB COPY
1020CMP #0 \BOTTOM OF SCREEN
1030 BNE NEOS \NOT END OF SCRN
1040 LDA SAV \GET X LSB COPY
1050 CMP #27 \LESS THAN 7 LINES
1060 BCC YEOS \YES
1070 .NEOS
1080 LDA SAV \GET COPY
1090 SEC
1100 SBC #28 \SUB 7 LINES
1110STA TABLE+2
1120 STA SAV
1130 LDA SAV1
1140 SBC #0 \MSB CARRY
1150 STA SAV1
1160 STA TABLE+3
1170 LDA #1
1180 JSR OSWRCH
1190 LDA #10 \PRINT LINE
1200 JSR OSWRCH
1210JMP LOOP2
1220 .YEOS \END OF SCREEN
1230 LDA #1
1240 JSR OSWRCH
1250 LDA #15
1260 JSR OSWRCH \CLEAR BUFFER
1270 LDA #1
1280 JSR OSWRCH
1290 LDA #10
1300 JSR OSWRCH
1310 RTS \BASIC
1320 .MAKEB
1330 CMP #0
1340BEQ ZERO \>1?
1350LDA #1 \YES-SET TO 1
1360.ZERO
1370 PHA \SAVE 'A'
1380 LDA #7
1390 SEC
1400 SBC &83 \INVERT LN COUNT
1410 TAY \PUT IN 'Y'
1420 PLA \GET BYTE
1430.SHIFT
1440 CPY #0 \UNTIL 'Y'=0
1450 BEQ ST
1460 ASLA
1470 DEY
1480 JMP SHIFT
1490 .ST
1500 ORA &84 \SET CALCULATED
1510 STA &84 \BIT IN GRAPHS
1520 RTS \MAIN ROUTINE
1530]
1540TABLE=P%:P%=P%+5:SAV=P%:SAV1=P%+1
1550 MSB=TABLE DIV 256
1560 LSB=TABLE MOD 256
1570 NEXT
```

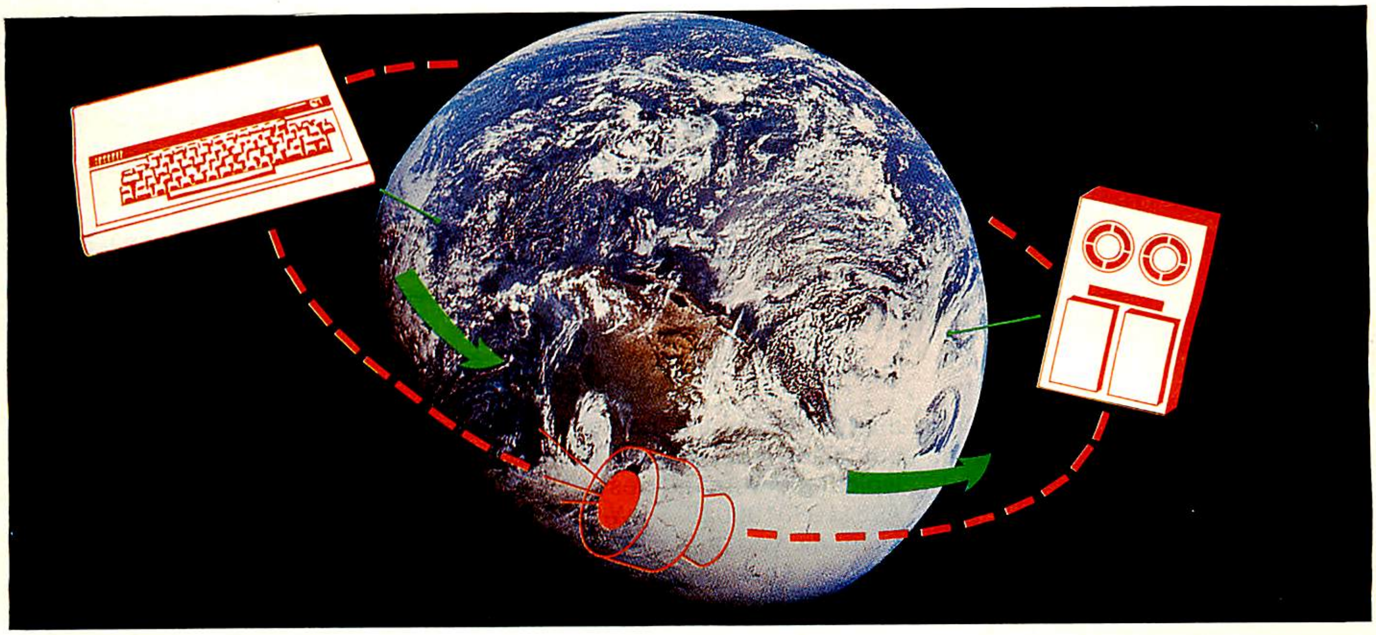
The BBC micro dials the world

with the help of Acorn's John Coll

Simple software can *transform* the BBC micro into an intelligent terminal with links to mainframe computers all over the world. At very modest costs, typically £2 for 10 minutes, users can:

- search the last 15 years' news reports for a particular word.
- ask for a report giving the floor plans of all Czechoslovak hospitals.
- book an air flight from Paris to New York.
- calculate components required for a low pass filter.
- order a record.
- join a worldwide conference.





Such facilities are widely used in the US, but Britain is only just waking up to the possibilities. The many different services available are accessed in a number of ways, but all require the same hardware and software on the BBC microcomputer system.

The first step is to dial one of a number of computers in the United Kingdom. The telephone hand-set is then plugged into an acoustic coupler which is connected to a BBC model B . The microcomputer must include a special sideways ROM designed for operating system 1.0. Acorn will be selling an acoustic coupler modem unit, and others are available for under £200. One disadvantage of an acoustic coupler is that loud noises may cause interference on the line.

Modems can also be used. These tend to be more expensive, and have to be connected to the telephone line – which needs British Telecom approval. However, it is a simple process to connect two wires to the telephone line! An advantage of a modem is that the BBC computer can dial automatically, or even answer the telephone.

Each of the services provided tends to be specialised. One I use enables me to chat to people in the US. Whatever I type on my keyboard appears on their screen and vice versa. Communication is slower than talking, but it is cheaper than telephone and ideal for holding a conference. Rewtel is a free 24-hour service on 0277 230959 run by *Radio and Electronics World*, a magazine typeset directly from the publishers own computer system. All their news stories are held on the dial-up computer, so people can access the information immediately.

The system is open 24 hours a day. It provides an electronic bingo card to request further information on new products, and an electronic mail system. Electronic components can be ordered, and future plans include the ability to download software.

Distel is another free dial-up service (01 683 1133), run by Display Electronics. You can browse through a computer catalogue, place an order and quote your credit card number directly into the system.

This may sound like Prestel, but none of the systems in this article are based on the BT service. The Prestel display demands a modem, and has a fixed display format of 40 characters per line and 24 lines. However, the systems discussed in this article have a free format and often make use of an 80-character display which is available on the BBC model B. Prestel users must have a password and an account, whereas you don't need either to use the systems mentioned above, although some more complicated systems do require passwords.

'This network enables you to send mail faster than air'

British Telecom Gold, set up by BT and Dialcom, offers an electronic mail system for commercial users. When you log on and give your identification code, the system lists any letters and phone messages stored. You can then scan through or read them individually. To reply, you just type the letter R, followed by your answer. This will be despatched directly back to the other person.

There are thousands of useful options. You can check whether a person has read and deleted your letter, or arrange for an acknowledgement to be sent to you the second he reads your letter. You can forward a letter to another user or send out multiple copies to various people.

Another facility of the Gold system is the diary, which is easy to use and flexible. Items in the diary can be corrected by your secretary, but other people have only limited access. They can read the title of a meeting but not any comments you have made. The diary can print out your day's, week's or month's engagements or search back for a meeting with a certain person.

As well as these two facilities, there are hundreds of application programs on mortgage repayments through to calculating component values in electronic circuits. And

there is a large range of sophisticated games. When you play Startreck (but called Asterisktreck), the system modestly asks your name to put into its 11 million bytes of core! The Dialcom Gold computers are prime 5000 units and are connected to a worldwide network of similar machines. This network enables you to send mail faster than air and cheaper than telex. If you want to send telex you can do so directly through Telecom Gold and it will appear on some distant telex machine. The facilities go on and on.

If I want to send a letter to Ronnie Schnell in New York, I type MAIL SEND RONNIE and my system directs the letter to him. I know it will arrive in his mail box within four minutes of despatch from Cambridge. We use the system for exchanging computer programs. His copy of *Defenders* was sent over by electronic mail – quicker than sending a disc and more reliable! (More on Ronnie later.)

'Ronnie wrote the conference software we were using'

The network is based on the International Packet Switch System (IPSS). Access to IPSS is given by British Telecom after the user has purchased a network user identity code (NUI), which costs £25 a year. To access IPSS, you dial a computer in one of 12 British cities and type in your NUI. The computer then asks for the address of the computer you wish to talk to. A typical network address (NUA) is A9311030100028. Within five seconds you are connected, and will be asked by that distant computer to give an ID code. After that you are charged for the call and the amount of information passed between computers. A typical 10-minute satellite connection would cost about £200.

The network user address (NUA) given above belongs to one of the Prime 5000 computers in the US dedicated to running the Source system. Source Telecomputing Corporation offers a range of services in addition to those on Dialcom Gold. For example, Source subscribers have access to reports produced by the United Press International news agency. You can search these reports for a single subject and the computer will permit you to scan through all the related news stories, or you can read individual items. Again the system is not expensive. Membership fee is $100 and connect charges are reasonable.

And Telecom Gold can turn up some surprises. One day I typed the command NET-TALK which enables you to talk to people on the network. A few seconds after I logged in, sombody called Ronnie appeared on the system. We chatted for half an hour or so about various things: our interests in music; the type of computer we had; what we had been doing for the last few days. Only then did I realise he was in New York.

I asked if he did any serious programming or whether he just mucked around and played games on the system. I was put firmly in my place by being told that he had written the international conferencing software we were using!

However, some 15 minutes later I was surprised when he said: 'hold on, mum's calling. I think I have got to go and have supper'. I asked how old he was. The reply was 16!

It will not surprise you that a short time later Ronnie received a BBC computer system. He has since been invaluable in helping to prove the file transfer software Acorn have developed.

I have ended up chatting to 20 or 30 different people on the system and it looks as if my next trip to the States is going to consist of visiting them all.

I hope you find this as exciting as I do. The satellites, networks and mainframe computers are there to do our bidding. At Acorn, we are trying to put together software and set up discount rates so subscribers can log into a number of systems. It is likely such a package will be offered in January and I believe we could have 10,000 people on the system in the UK by 1984. But this will require careful planning as neither British Telecom Gold nor British Telecom are in a position to deal with large numbers of individual subscribers. Both are aiming their marketing at commercial organisations who can look after themselves.

'Satellites and mainframes are there to do our bidding'

Garbage and strings don't mix

Garbage is the bane of string handling as it can block up needed memory. Ian Birnbaum unties some of the mysteries and empties the trash cans.

Type program 1 into your computer, and run it. It will successfully create 100 strings, each of length 100 characters, on a model A, or 200 strings on a model B. Nothing spectacular in that!

Now change line 40 to

```
40N$(I%)=STRING$(50,"*")
```

and line 50 to

```
50N$(I%)=N$(I%)+STRING$(50,"*")
```

This program is the same length as the original, and ostensibly does the same, but when you run it you get the error message 'no room'. Why?

To understand this, we need to study briefly how the BBC micro stores strings. Consider program 1 again. Line 20 creates 101 (or 201 on a model B) sets of four-byte blocks, called *string information blocks* (SIBs). The first two bytes of this block point to the address in memory where the string is stored, and the next two bytes refer to the length of the string.

The DIM statement creates null strings, so at this stage each block will consist of four zeros.

On each loop through line 40, 100 bytes of memory are filled with 'asterisks' (ie with 42, the ASCII code for an asterisk), and the relevant SIB is altered accordingly: the first two bytes will point to the area in memory where the relevant string is stored; and the last two will relate to its length. I shall have more to say about these two bytes later.

So on exit at line 80, 101X104 (or 201X104) bytes of memory will have been used up to store the array N$( ).

In fact slightly more bytes than this will be used, but I shall retain this simplification for the moment.

Consider now the effect of the changes to 40 and 50. On each loop through 40, 50 bytes of memory will be filled with asterisks, and the relevant SIB altered accordingly. Line 50 requires a further 100 bytes of memory to be filled with asterisks, and the SIB is altered again. Thus a total of 150 bytes will be used up: the 50 bytes from line 40 plus the 100 bytes from line 50.

The SIB of the string will point to the beginning of the 100 byte segment of memory. The old 50-byte segment is now filled with unwanted data – usually called garbage.

Hence on exit from line 60 101X154 (or 201X154) bytes of memory would have been used up, if it were not for the running. However, 101x50 (or 201X50) of these will be garbage. Some interpreters have special garbage collection routines to cope with this, but not the BBC computer.

This is not as disadvantageous as it sounds, since garbage collection routines are generally slow, and as we shall see below, the BBC micro has other ways of solving the problem.

Let us do another experiment now, to show this problem is not confined to arrays. Type program 2 into your computer and run it. You will get a 'no room' error. This is even more startling than the last example, since you have only attempted to define 10 strings! But if you follow it through you will see that for each value of K% you use up over 3254 bytes (10+20+...+250) of which at least 3000 bytes are garbage! Now change line 10 to:

```
10FOR K%=1 TO 10: J%=260
```

and line 20 to:

```
20J%=J% - 10
```

and run it again. This time you are successful!

How can this remarkable difference occur from such simple changes to the program?

Program 1. Produces strings of 100 characters.

```
>REM LISTING 1
>L.
   10MODE7: IF HIMEM<&4000 THEN N%=100
     ELSE N%=200
   20DIM N$(N%)
   30FOR I%=0 TO N%
   40N$(I%)=STRING$(100,"*")
   50REM****SPACE FILLER****
   60NEXT
   70PRINT'"Finished"
   80END
```

```
>REM LISTING 2
>L.
   10FOR K%=1 TO 10: J%=0
   20FOR I%=0 TO 25
   30J%=J%+10
   40PROCTEST(J%,K%)
   50NEXTI%,K%
   60PRINT'"Finished":END
   70DEF PROCTEST(A%,B%)
   80GOTO(80+B%)
   81A$=STRING$(A%,"*"): ENDPROC
   82B$=STRING$(A%,"*"): ENDPROC
   83C$=STRING$(A%,"*"): ENDPROC
   84D$=STRING$(A%,"*"): ENDPROC
   85E$=STRING$(A%,"*"): ENDPROC
   86F$=STRING$(A%,"*"): ENDPROC
   87G$=STRING$(A%,"*"): ENDPROC
   88H$=STRING$(A%,"*"): ENDPROC
   89I$=STRING$(A%,"*"): ENDPROC
   90J$=STRING$(A%,"*"): ENDPROC
```

Program 2. Fails to store just ten strings

In line 30, J% begins at 250, and so the effect of the procedure will be to fill 250 bytes of memory with asterisks and point the first two bytes of the SIB for A$ to this area. The fourth byte of the SIB will be 250, and the third, 255.

On the next loop, J% is 240, and the computer will put 240 bytes of asterisks into the same area of memory as the 250 bytes were put: that is, it will overwrite them.

The fourth byte of the SIB will now be 240, but the third will still be 255. It is the value of this crucial third byte which determines whether the same area of memory can be overwritten.

If the new data length does not exceed this third byte, overwriting can occur; and the value of this third byte always corresponds to the longest string allocated to A$ so far (plus eight, at most).

This is why the simple expedient of starting with a data allocation of 250 asterisks for each string solves the memory problem. On exit at 60, only 2590 bytes have been used to store the ten strings.

Thus, in the SIB the third byte gives the available space for a string starting at the address pointed to by the first two bytes; and the fourth byte gives the length of the current string at that address. Whenever a string variable is first defined, its available length is always eight more than its current length (subject to a maximum of 255). So a ten-character string will have 28 bytes allocated to it. As long as a redefinition of a string variable never exceeds 18 bytes, no additional storage space will be used. And no garbage is therefore created.

The only disadvantage with this method of string allocation is that immediate string allocations in programs (eg F$="ABC") and strings in DATA statements have to be copied from the program into storage memory – in most Basics the SIB could point directly to the string in the program itself.

A similar problem exists with local variables, and can be solved in the same way. Add to program 2 (with lines 10 and 20 as in the original testing) line 75, as follows:

```
75LOCAL A$,B$,C$,D$,E$,F$,G$,H$,I$,J$
```

and run the program again. 'No room' as before. Now insert:

```
0A$=STRING$(250,"*")
1B$=A$
2C$=A$
3D$=A$
4E$=A$
5F$=A$
6G$=A$
7H$=A$
8I$=A$
9J$=A$
```

and run again. This time there is no problem!

The reason is that when a local variable is created, if a global variable with the same name exists – with at least as much available space as the local variable needs – the contents of that global variable SIB are borrowed for the duration of the local variable's existence.

The value of the global variable is saved on the Basic stack, which is why the program is so slow: the value has to be deposited and removed every time.

In the same way, if we create a local variable of length L, and no global variable with the same name exists, a global variable SIB will be left after the local variable has been destroyed, with available space L+8 and current length zero.

And, if a global variable *does* exist, but has an available space of less than L, prior to the local variable being defined, when the global variable is restored, it will have available space of L+8 and current length as before.

But in this case, the global string will be put into a new area of memory, creating garbage from the data in the old area of memory previously used for the global variable.

In all cases, if a global variable of the same name exists, the local variable will use the *same* physical SIB, and any increase in available space will remain when the global variable is restored. If. a global variable dos not exist, a global SIB will be created.

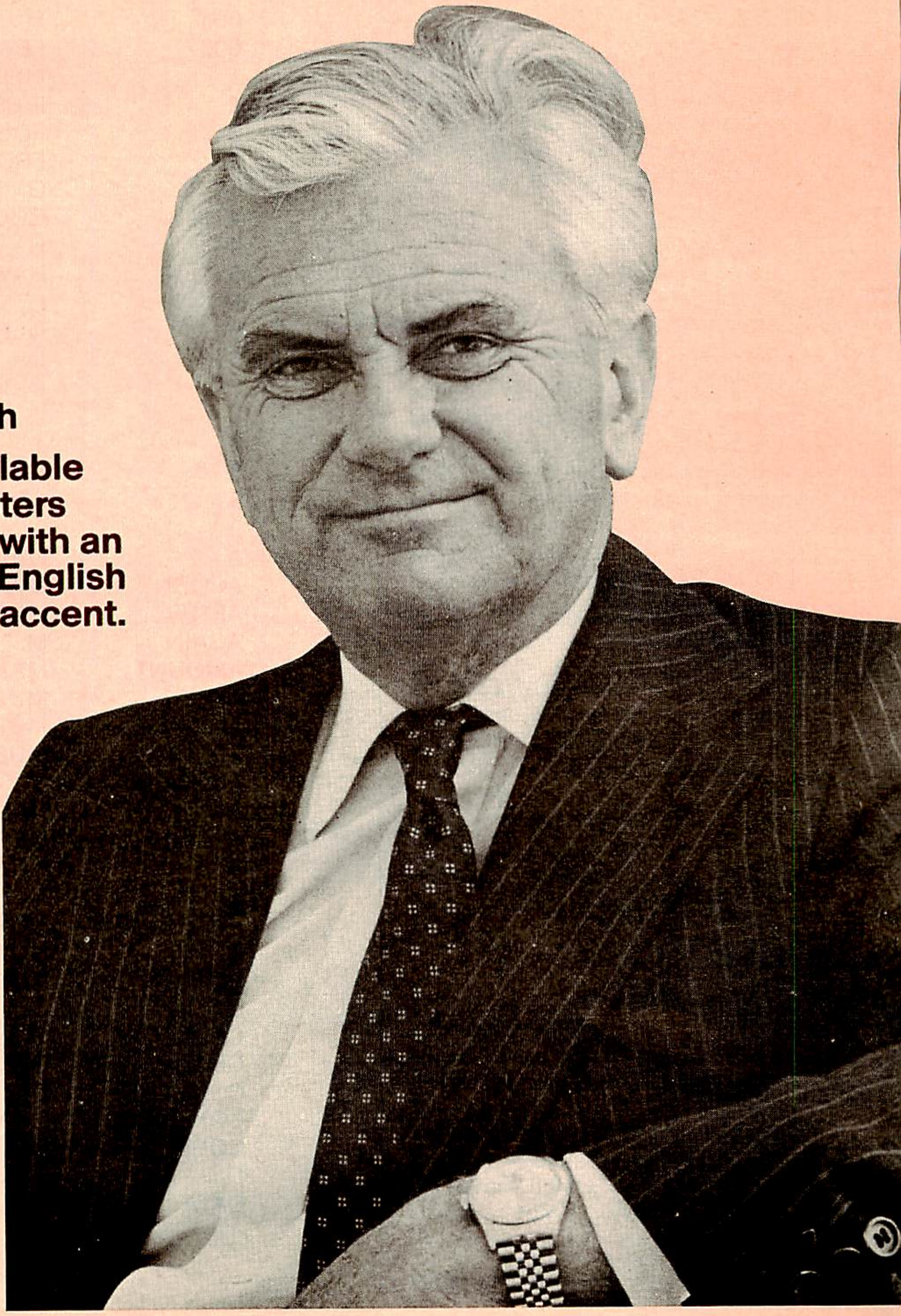
From these experiments we can formulate a rule which will help us to promote the careful husbandry of strings on the BBC microcomputer. Always assign the maximum likely length to a string when it is first defined, whether it is first met locally or globally. If necessary, execute an 'artificial' allocation using STRING$.

Here is the news . . .

THE BBC MICRO SPEAKS

. . . with the voice of Kenneth Kendall

BBC TV news reader Kenneth Kendall provided the voice recordings from which Acorn's speech memory was built up. The tapes were edited and digitised to produce one of the few speech systems available for computers with an English accent.



A unique feature of the BBC microcomputer is the on-board speech synthesis option. This will soon be released as a set of chips which expands the BBC machine to give speech synthesis via the sound generator, amplifier and speaker.

The Acorn speech synthesis option uses the Texas Instruments TMS 5220 Voice Synthesis Processor (VSP) with speech data in an associated word phrase read only memory (word PHROM). The expansion requires the addition of two speech integrated circuits and a version 1.0 operating system. Dealer modification of early issue printed circuit boards may also be required.

Kenneth Kendall, the BBC newsreader, provided the recordings from which the speech PHROM was made. These recordings were digitised to be processed by the VSP. After final edit the speech system is one of the few available with an English accent.

The first word PHROM (word

PHROM A) which is provided with the initial speech expansion contains 165 phrases. Some are discrete words and others are prefixes or suffixes (see figure 1). The latter greatly expand the vocabulary by giving combinations to form composite words. For example:

> the word component POUN
> may be combined with -D to say 'pound'
> may be combined with -Z to say 'pounds'
> and may be combined with -D and -ING to say 'pounding'.

There are some words contained within word PHROM A which are associated with one textual meaning but are phonetically identical to a number of other words.

> the word 4
> may be used to speak 'for' or 'fore'
> and the word u
> may be used to speak 'you'

With experimentation and a little imagination the enterprising user will be able to create a surprising number of meaningful words and phrases. The computer can be made to say 'which programs do you want to use?' by stringing together the phrases:

> WHICH PROGRAM -Z DO U WANT 2 U -Z

Operation of the speech facility is available via the Sound command from Basic and via OSWORD calls in machine code. The Sound command is used to place a speech request into the speech buffer which can queue up to 21 phrases. The operating system manages the buffer, feeding each phrase to the VSP as previous phrases terminate.

The Sound command requires a phrase number in the range 32 to 291 (in the case of other PHROMs the upper limit may be different). Phrase numbers in the ASCII character range (32 to 126) will produce phrases which have an association with that ASCII character. Hence:

> upper-case letters give the letter of the alphabet.

(0.125)
(0.25)
(TONE1)
(TONE2)
-D
-ED
-ING
-S
-TEEN
-TH
-TY
-Z
0
00
000
1
2
2-
3
3-
4
4-
5
5-
6
6-
7
7-
8
8-
9
9-
A
ACORN
AFTER
AGAIN
AMOUNT
AN
AND
ANOTHER
ANSWER
ANY
AVAILABLE
B
BAD
BETWEEN
BOTH
BUTTON
C
CASSETTE
CHARACTER
COMPLETE
COMPUTER
CORRECT
D
DATA
DATE
DO
DOLLAR
DONT
DOWN
E
EACH
ELEVEN
ENGAGED
ENTER
ERROR
ESCAPE
F
FEW
FILE
FIRST
FOUND
FROM
G
GOOD
H
HAVE
I
ILLEGAL
IN-
INPUT
IS
J
K
KEY
L
LARGE
LAST
LINE
M
MANY
MINUS
MORE
MUST
N
NAME
NEGATIVE
NEW
NO
NOT
NOW
NUMBER
O
O'CLOCK
OF
OFF
OLD
ON
ONLY
OR
P
PARAMETER
PENCE
PLEASE
PLUS
POINT
POSITIVE
POUN-
PRESS
PROGRAM
Q
R
RED
RESET
RETURN
RUN
RUNNING
S
SAME
SCORE
SECOND
SMALL
START
STOP
SWITCH
T
TEN
THANK
THAT
THE
THEN
THIRD
THIS
TIME
TRY
TWELVE
TYPE
U
UH
UP
V
VERY
W
WANT
WAS
WERE
WHAT
WHICH
X
Y
YEAR
YES
YOUR
Z

numeric characters give the numbers.
lower-case 'y' gives 'yes'.
lower-case 'n' gives 'no'.

Phrases which have ASCII associations can also be obtained using a phrase number in the range 127 to 291 where all the phrases are arranged in alphabetical order.

In BBC Basic two ways to say the word 'yes' are:

Using the ASCII associated phrase number SOUND -1, ASC ("y"), 0, 0

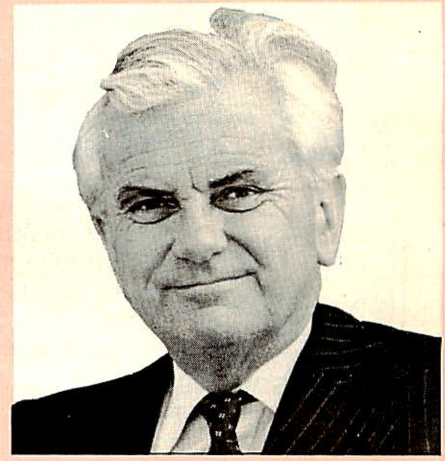
Using the alphabetically-ordered phrase number SOUND -1, 289, 0, 0

Two tones and two pauses are available in the first word PHROM. The two pauses are (0.125) and (0.25) where the figure in brackets indicates the length in seconds. The tones are called TONE1 aand TONE2, the second having a lower pitch than the first.

Data contained within the PHROM includes the text strings associated with each phrase. These text strings will be used by speech utility programs which, without prior knowledge of the PHROM contents, will be able to look up phrases. The format of the word PHROM has been rigorously defined by Acorn so speech utilities may be used with any new PHROM which may be released.

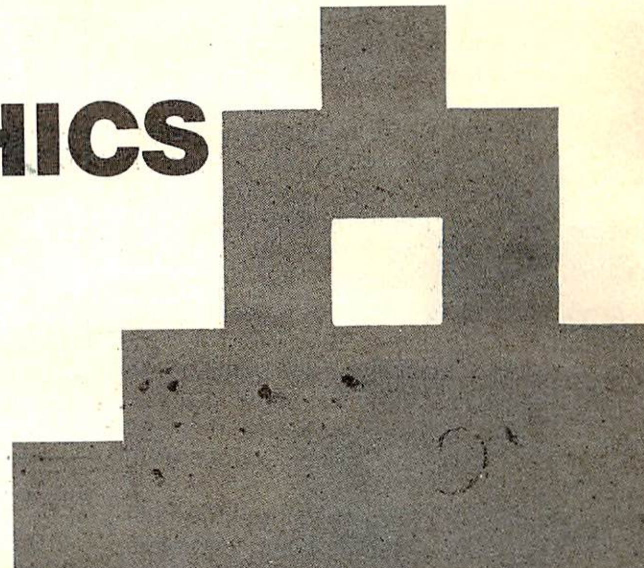
Another exciting prospect is the use of PHROMs for a data or program storage. These devices are designed so they may be plugged into slots at the edge of the keyboard.

Further developments are being pursued with speech from allophones – the speech sub-components combined to produce almost all spoken words. Using allophones, phrases may be constructed with improved emphasis and intonation so that the meaning of the phrase is reflected in the pronunciation of each word. The use of allophones enables words to be pronounced without the restriction of a fixed vocabulary.



The speech synthesis ROM will be available before Christmas and cost about £25 including VAT. The The chip simply plugs into the board inside the BBC micro. However, machine operating system 1.0 must be fitted for the voice option to work. So, if you want your Beeb to produce BBCspeak, go to it.

PITCH ENVELOPE AND MOVING GRAPHICS



Joe Telford homes in on UFOs and space bugs

In the last issue I examined the amplitude envelope, and pointed out that the envelope statement contained a facility to alter both pitch and frequency. Remember that the envelope state is followed by 14 parameters, subscripted as follows via the full *User Guide*:

ENVELOPE N,T,PI1,PI2,PI3, PN1,PN2,PN3,AA,AD,AS,AR, ALA,ALD

The BBC micro's pitch envelope is explained in figure 1. The envelope is set up around a base frequency which is the value in the associated sound statement.

For example SOUND 1,1,101,100 would give a base frequency of 101 (middle C). This is controlled through parameters N,T,PI1,PI2, PI3,PN1,PN2,PN3.

N, is the waveform number from 1 to 4. T is the length of step in 1/100s of the envelope from 0-127, although values over 127 can be used as described below. The next six parameters are grouped in pairs – PI1 & PN1, PI2 & PN2, PI3 & PN3.

The pitch envelope in Figure 1 is based around middle C, and has three sections. We can describe the waveform as follows.

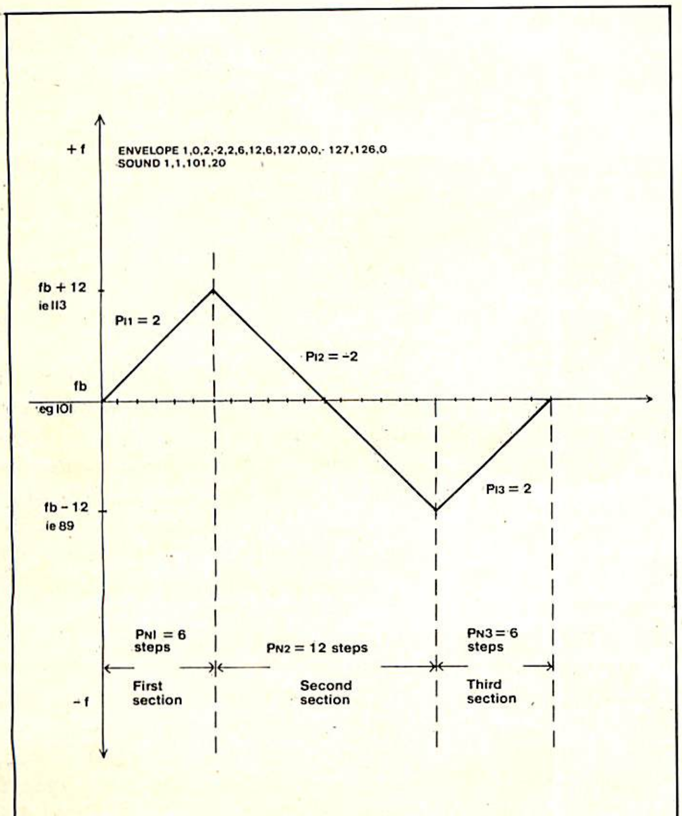


Figure 1. Typical pitch envelope

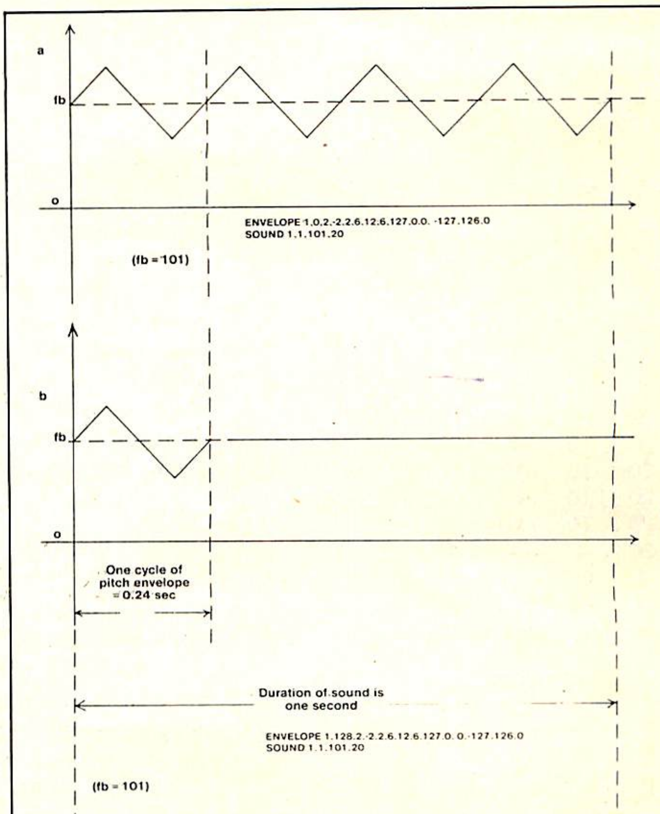


Figure 2.(a) repeating envelope (b) non-repeating

The parameter T is 0, meaning steps of 1/100s. During each step of the first section the frequency rises by a value of two (PI1) so at the end of the section the base frequency is increased by six steps at two per step = 12 to a level of 113.This is the frequency value for the second section, which has 12 steps (PN2) taking 12/100s. During each step the frequency DROPS by a value of two (PI2 = -2). So at the end of section two the frequency has reduced to 113 + (12 x -2), or 113 - 24 = 89.

Section three is similar to section one and the result is a rise of 12 pitch values over 6 steps (PN3), giving a rise of 2 values (PI3) per step.

As you can see, the time this waveform takes to complete totals PN1 + PN2 + PN3 = 24 steps. Because each step takes 1/100s (set by T), the waveform should stop after 24/100s, or approximately 1/4s. But try the program:

```
10 ENVELOPE 1,0,2,-2,2,6,12,6
   127,0,0,-127,126,0
20 SOUND 1,1,101,20
RUN
```

Amazement! The sound continues for a full second – because values of T less than 128 will cause the pitch envelope only to auto repeat for the full length of time set by the SOUND command. Compare the effect gained by altering line 10 to:

```
10 ENVELOPE 1,128,2,-2,2,6,12,
6,128,0,0,-127,126,0
```

Figure 2 illustrates what happens. In figure 2a the waveform repeats to the end of the note, while in figure 2b the waveform cycles once, then continues at the final frequency until the end of the time set in the sound statement.

T	PI1	PI2	PI3	PN1	PN2	PN3
0	2	–2	2	6	12	6
10	2	–2	2	6	12	6
0	1	–1	1	6	12	6
0	1	1	1	6	12	6
1	–2	1	1	6	12	6
1	–10	1	–10	6	12	6
0	2	0	2	6	12	6
1	10	0	–10	1	2	1
10	10	0	–10	1	2	1
20	10	–10	0	2	2	0
20	10	–10	0	2	2	1
20	10	–10	0	3	3	3
20	4	–4	0	12	12	3
2	20	0	–20	1	2	1
2	2	0	–2	1	2	1
2	50	50	50	2	2	2
1	2	–2	2	127	127	127
1	20	–20	20	127	127	127

Figure 3. Experimental values based on: ENVELOPE 1,0,2,-2,2,6, 12,6,127,0,0,-127,126,0

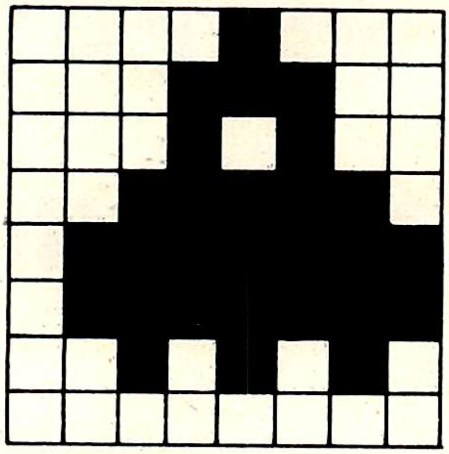


Figure 4. User defined character for UFO. VDU 23,224, 8,28,20,62,127 127,42,0

Before continuing, experiment with this pitch envelope, trying the values in figure 3, then using base values in the sound statement of 53,101 and 149. (C is an octave apart.)

Setting the duration to 100 will improve listening time. The remainder of the parameters are, of course, our faithful old amplitude parameters.

All the amplitude parameters we have used in this article have been selected to give full volume over the duration of the sound and it is possible to combine envelopes so, say, a wailing siren appears to approach and recede – all in 2 lines. For example:

```
10 ENVELOPE 1,1,2,-2,2,6,12,6,1,
   1,-1,-1,63,126
20 SOUND 1,1,101,200
```

The envelope command allows a far greater control over sound waveforms than I have space to describe. I would strongly suggest you experiment, particularly with the envelopes for SOUND channel 0, the white noise generator. This will be the subject of a future Hints & Tips.

I should mention here that in the home continuous wailing waveforms at full volume can lead to problems with family and neighbours – perhaps that is why Acorn set up 16 levels of volume on their machine.

To run all the waveforms mentioned above more quietly, halve the last two parameters of each envelope statement.

This is not a complete solution – as I said last month, the amplitude waveform is a combination of several parameters – but it works acceptably well if the concern is only for a pitch envelope.

Now I shall consider four particular areas on moving graphics:

- single character text movement.
- multiple character text movement.
- graphic movement.
- simulated movement using assigned colours.

Because the first contains many tips needed for the other areas, I shall examine it in some detail this month. First however, I shall define the difference between graphic movement and text movement.

Text movement, works on all text modes – with letters or defined characters – while graphic movement is related to the full graphics screen, moving individual dots by tiny displacements.

Text movement uses the comparatively large displacement of whole character squares.

Some ground rules first. We are using text modes so there will be variations in screen widths. Single character text movement has to take account of the width and height of the screen for the particular mode used, otherwise unplanned things will happen, such as shapes reappearing on the opposite side of the screen, and the screen scrolling up or down.

It is also worth noting that in single character text, each character is allowed only two colours – the background and the foreground. So if you move two different coloured shapes before moving either shape, then colour needs reaffirming in a COLOUR statement.

Because we are using text

```
90REM*UFO TAKE-OFF*
100REM*ALLOCATE A UFO TO CHR$(224) *
110:
120VDU23,224,8,28,20,62,127,127,42,0
130ufo$=CHR$(224)
140:
150REM*SET UP A BLUE SKY*
160:
170MODE5:VDU19,129,4,0;0;0;
180COLOUR129:CLS
190:
200REM*PLACE UFO AT BOTTOM*
210:
220PRINTTAB(10,31);ufo$
230:
240REM*WAIT FOR 10 SECS OR KEYPRESS*
250:
260wt$=INKEY$(1000)
270:
280REM*MOVE UFO UP WITH *
290REM*32 PRINT STATEMENTS *
300:
310FOR J=1 TO 32
320PRINT
330:
340REM*SHORT DELAY BETWEEN PRINTS *
350REM*MAKES MOVEMENT MORE        *
360REM*REALISTIC                  *
370:
380FOR delay =1 TO 250:NEXT
390NEXT
```

Program 1

characters, albeit redefined ones, movement occurs by judicious printing – as we demonstrated below.

Finally, single character printing is very fast. To see movement as more than a blur, your programs, even in BASIC, will need slowing down. Hence the delay loops, in each program.

To aid readability, most of the programs which follow are well REM'd, and include blank lines commencing with colons. Both the REM and colon lines can be removed without altering each program's function.

For continuity's sake I have used in each case other than the last example the same user-defined character.

At the beginning of each program CHR$(224) is defined to be a UFO – see figure 4, which is stored in variable 'ufo$'. Because we are considering movement in all directions it is useful to be realistic – for example to have a shape capable of moving in all directions. I could have just as easily used a ball, UFOs, though, are more fun.

Program 1 demonstrates the simplest way to produce movement. After producing our UFO, we simply place it at the bottom of the screen – as in line 220 – and then a short pause (line 260) print 32 blank lines.

Because printing on the last line of the screen causes scrolling, the whole screen moves upward one line at a time – taking the UFO with it, with the effect that the blank lines push up the UFO. Alter the 250 of line 380 to change the rate of ascent, and the 32 of line 310 to change the height reached. 32 is the screen height in mode 5, and so guarantees to send the UFO off the screen.

Another amendment is to have a fleet of UFOs fly past. Simply remove line 260 and add a new line 400:

```
400 GOTO 220
```

The only way out of this amendment is via ESCAPE.

One useful facility of the BBC micro is its ability to scroll downwards, so an object on the top of the screen can be moved to the bottom simply by downward scrolling. Program 2 demonstrates this.

To aid understanding I have written it as similarly as possible to program 1. Note that line 220 puts the UFO initially at the top of the screen, while the downward scrolling is performed by the VDU 11 of line 320. The loop at line 310 ensures that the UFO reaches the bottom.

32 PRINTs in program 1 move the UFO off the top of the screen, while 32 VDU 11s only move the UFO to the bottom of the screen, because of the position of the cursor (which tells you where printing will begin) after printing the UFO.

```
90REM*UFO LANDING*
100REM*ALLOCATE A UFO TO CHR$(224) *
110:
120VDU23,224,8,28,20,62,127,127,42,0
130ufo$=CHR$(224)
140:
150REM*SET UP A BLUE SKY*
160:
170MODE5:VDU19,129,4,0;0;0;
180COLOUR129:CLS
190:
200REM*PLACE UFO AT TOP*
210:
220PRINTTAB(10,0);ufo$
230:
240REM*WAIT FOR 10 SECS OR KEYPRESS*
250:
260wt$=INKEY$(1000)
270:
280REM*MOVE UFO DOWN WITH *
290REM*32 VDU 11 STATEMENTS *
300:
310FOR J=1 TO 32
320VDU11
330:
340REM*SHORT DELAY BETWEEN PRINTS *
350REM*MAKES MOVEMENT MORE        *
360REM*REALISTIC                  *
370:
380FOR delay =1 TO 250:NEXT
390NEXT
```

Program 2

```
100REM*UFO SIDEWAYS*
110REM*ALLOCATE A UFO TO CHR$(224) *
120:
130VDU23,224,8,28,20,62,127,127,42,0
140ufo$=CHR$(224)
150:
160REM*SET UP A BLUE SKY*
170:
180MODE5:VDU19,129,4,0;0;0;
190COLOUR129:CLS
200:
210REM*PLACE UFO ON LEFT *
220:
230PRINTTAB(0,15);ufo$
240:
250REM*WAIT FOR 10 SECS OR KEYPRESS*
260:
270wt$=INKEY$(1000)
280:
290REM*MOVE UFO RIGHT WITH *
300REM*19 PRINT TABS AND   *
310REM*PRINT SPACES.       *
320:
330FOR J=0 TO 18
340PRINT TAB(J,15);" ";ufo$
350:
360REM*SHORT DELAY BETWEEN PRINTS *
370REM*MAKES MOVEMENT MORE        *
380REM*REALISTIC                  *
390:
400FOR delay =1 TO 500:NEXT
410NEXT
```

Program 3

In both programs 1 and 2 the cursor flashes on the line below the UFO, so in program 2 the PRINT statements can begin pushing the UFO upwards immediately. In Program 2, however, it requires 1 of the VDU 11 commands to get the cursor back up to the same line as the UFO.Only 31 of the VDU 11 commands, therefore, are effective in pushing the UFO down the screen.

You will be aware that scrolling screens not only moves your UFO but also anything else on the screen – things which may need to remain steady, such as stars and planets. We need, then, a more general solution to the problem of mobilising UFOs.

Fortunately, the inability of the micro to scroll sideways forces us to probe this question.

The general algorithm for single character movement is:

1 PRINT a shape in its first position.
2 Wait for a while to let it register on our eyes.
3 PRINT a blank – erase it.
4 Quickly rePRINT the shape in its new position.
5 Repeat steps 2 to 4 until finished.

Program 3 demonstrates how this algorithm works to move the UFO to the right. Line 230 places the UFO on the left of the screen, about halfway up. Line 340 performs steps 3 and 4 in the algorithm

```
500FOR J=18 TO 0 STEP-1
510PRINT TAB(J,15);ufo$;" "
520FOR delay =1 TO 500:NEXT
530NEXT
```

Program 4

```
100REM*RANDOM UFO*
110REM*ALLOCATE A UFO TO CHR$(224) *
120:
130VDU23,224,8,28,20,62,127,127,42,0
140ufo$=CHR$(224)
150:
160REM*SET UP A BLUE SKY*
170:
180MODE5:VDU19,129,4,0;0;0;
190COLOUR129:CLS
200:
210REM*START UFO AT CENTRE*
220:
230X=10:Y=14
240:
250REM* PRINT UFO AT PRESENT POSTN*
260:
270PRINTTAB(X,Y);ufo$
280:
290REMEMBER THE DELAY BETWEEN MOVES?
300:
310FOR wt=1 TO 250:NEXT
320:
330REM*DECIDE ON DIRECTION*
340REM*1=UP:2=DOWN:3=LEFT *
350REM*4=RIGHT:5=UL:6=UR  *
360REM*7=DL:8=DR:9=STILL  *
370:
380dir=RND(9)
390:
400REM SET DISPLACEMENTS ACCORDINGLY
410:
420IF dir=1THEN XON=0:YON=-1
430IF dir=2THEN XON=0:YON=1
440IF dir=3THEN XON=-1:YON=0
450IF dir=4THEN XON=1:YON=0
460IF dir=5THEN XON=-1:YON=-1
470IF dir=6THEN XON=1:YON=-1
480IF dir=7THEN XON=-1:YON=1
490IF dir=8THEN XON=1:YON=1
500IF dir=9THEN XON=0:YON=0
510:
520REM*CHECK ON FALLING OFF SCREEN*
530:
540PROC_CHECK
550:
560REM* IF OFF EDGE TRY AGAIN*
570:
580IF NOGOOD THEN 380
590:
600REM*  OK SO MOVE UFO *
610:
620PRINTTAB(X,Y);" "
630X=X+XON:Y=Y+YON
640GOTO270
650END
660:
670:
680:
690DEFPROC_CHECK
700NOGOOD=0
710REM CHECK FOR R&L EDGES
720IFX+XON>19 THEN NOGOOD=-1
730IFX+XON<0 THEN NOGOOD=-1
740REM CHECK FOR T&B EDGES
750IFY+YON>30 THEN NOGOOD=-1
760IFY+YON<0 THEN NOGOOD=-1
770ENDPROC
```

Program 5

above, while line 400 performs step 2.

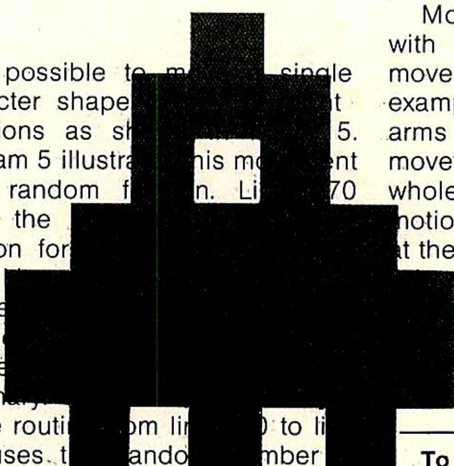
The loop is 19 steps long, set in line 330, and this matches the width of the screen in mode 5. Setting mode 4 or 0 would need this loop to be altered to 38 or 78.

This process can be reversed to make the UFO travel backward, ie to the left. Program 4 is a routine which can be added onto program 3 to allow the UFO to move back across the screen. It is unREM'ed so you can see how concise it is.

Line 500 requires the STEP-1 to enable the loop to progress from 18 downwards. Consequently, the TAB statement moves the PRINT position from right to left. The addition of a line 540:

540 GOTO 330

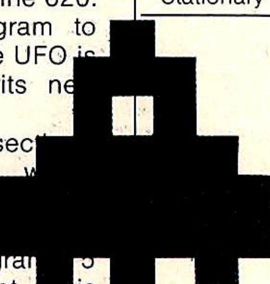
will allow the backwards-forwards motion to continue indefinitely.



It is possible t[illegible] single character shape[illegible]t directions as sh[illegible] 5. Program 5 illustr[illegible]his m[illegible]nt in a random f[illegible]n. Li[illegible]70 prints the [illegible] position for[illegible] 310. [illegible] numbe[illegible] directi[illegible] numbe[illegible] station[illegible].

The routi[illegible]om li[illegible]) to li[illegible] 500 uses t[illegible]ando[illegible]mber set a value for XON (1,0, or-1) and for YON (1,0, or-1). Movement in each of the directions of figure 5 can be expressed as a displacement horizontally (XON) plus a displacement vertically (YON) (figure 6).

The additions of figure 6 are performed in line 630 – after the UFO has been blanked by line 620. Line 640 forces the program to return to line 270, where the UFO i[illegible] reprinted – this time in its ne[illegible] position.



At the beginning of this sec[illegible] mentioned that problems [illegible] occur if the shape was all[illegible] try to leave the screen, [illegible] direction. Because progra[illegible] allows random movement, [illegible]is problem normally arises during the program run.

The PROCEDURE at line 540 tests for a possible off-screen position and returns the variable NOGOOD = -1 if the UFO is about to leave the screen. This variable is tested in line 580, and if set to -1 another direction is chosen after a jump back to line 380.

Most games involve characters with many moving parts which move in many directions. For example, a walking character has arms and legs with individual movements, yet the character as a whole has a generally forward [illegible]otion. Up to now we have looked [illegible]t the whole shape's movement, but [illegible]ossible to demonstrate other [illegible] moving.

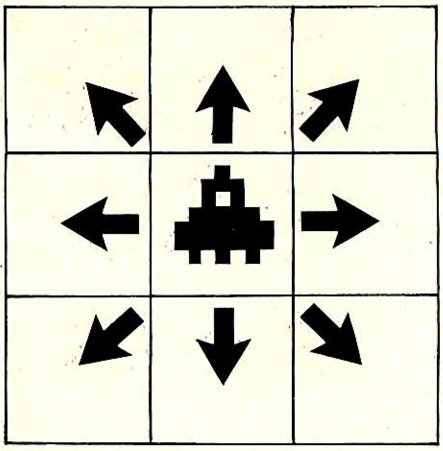
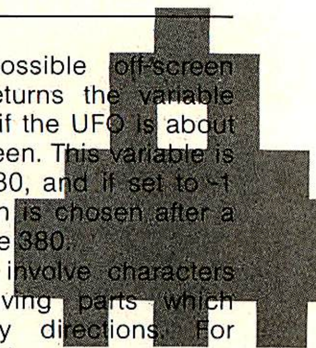


Figure 5. Possible directions for single character



To move	Alter X value to	Alter Y value to
Up	X + 0	Y − 1
Down	X + 0	Y + 1
Left	X − 1	Y + 0
Right	X + 1	Y + 0
UL	X − 1	Y − 1
UR	X + 1	Y − 1
DL	X − 1	Y + 1
DR	X + 1	Y + 1
Stationary	X + 0	Y + 0

Figure 6. Horizontal and vertical increments for the nine directions

```
100REM* SPACE-BUG *
110ENVELOPE1,0,2,-2,2,6,12,6,127,0,0,-127,126,0
120ENVELOPE2,1,-2,1,1,6,12,6,127,0,0,-127,126,0
130VDU23,224,24,60,126,219,126,36,66,129
140bug1$ =CHR$(224)
150VDU23,225,24,60,126,219,126,36,66,36
160bug2$ =CHR$(225)
170MODE4
180VDU19,0,2,0;0;0;:COLOUR128
190VDU19,1,1,0;0;0;:COLOUR1
200CLS
210FOR loop= 1 TO 5
220SOUND&11,1,101,255
230FOR X= 1 TO 38
240PRINTTAB(X,15);" ";bug1$
250FOR delay = 1 TO 100:NEXT
260PRINTTAB(X,15);" ";bug2$
270FOR delay = 1 TO 100:NEXT
280PRINTTAB(X,15);" ";bug1$
290FOR delay = 1 TO 100:NEXT
300PRINTTAB(X,15);" ";bug2$
310FOR delay = 1 TO 100:NEXT
320NEXT
330SOUND&11,2,101,255
340FOR X= 38 TO 1 STEP-1
350PRINTTAB(X,15);bug1$;" "
360FOR delay = 1 TO 100:NEXT
370PRINTTAB(X,15);bug2$;" "
380FOR delay = 1 TO 100:NEXT
390PRINTTAB(X,15);bug1$;" "
400FOR delay = 1 TO 100:NEXT
410PRINTTAB(X,15);bug2$;" "
420FOR delay = 1 TO 100:NEXT
430NEXT
440NEXT
450SOUND&11,0,101,0
460END
```

Program 6

The 'space bug' of program 6 develops this theme to produce a one character creature whose legs move differently to its body. The whole shape moves forward across the screen using lines 230 to 320, and back again with lines 340 to 430.

Within each of these routines the bug is printed in each character space with its legs in different positions. This trick creates the illusion of a running motion.

In fact we need 2 bugs – defined in lines 130 to 160 – and printed alternately. The program runs in mode 4 and has a red/yellow screen set by lines 170 to 200.

In conclusion, I also offer in the same program an application for pitch envelopes. While the bug runs forward, envelope 1 sounds. While the space bug runs back, envelope 2 sounds. Lines 220 and 330 are responsible for this.

At the end of the sound statements the 255 makes the associated envelope sound continually. This happens only until the next sound command – where its &11 parameter cancels the current sound and starts a new one.

Line 450 is a 'dummy' line to switch off the sound at the end of the program. It is therefore possible to initiate complex sounds, and perform simultaneous processing of text or graphic characters, and finally – when convenient – turn off the sound. This is an extremely powerful facility.

Next issue: Joining up characters, moving them, and some ideas on speeding up programs.

PRINTING GRAPHICS ON THE CHEAP

Matthew Bates takes one of the cheapest printers around – the ZX machine – and tags it onto the end of an Atom

Most modern computers have a printer interface, but now a printer is often more expensive than the computer itself. An exception is the Sinclair ZX printer. This article is for those of you who don't own a ZX81 but still want to connect this printer to your own system. The software is designed for the Atom but could be adapted for the BBC micro.

The printer works in the following way. A small metal stylus is dragged across the aluminium-coated paper at high speed. When a dot is required the stylus is turned on causing a large current to flow through the aluminium, vaporising it and exposing the black paper underneath. The printer does in fact have two styli mounted on a continuous rotating belt to avoid delay while the stylus returns. The paper is fed continuously, driven by a worm gear linked to a belt drive. The simple DC motor has no speed regulation which means that some form of feedback is required to ensure the dots are put in the correct place. This is provided by an encoder disc connected to the belt drive which sends 256 pulses as the stylus crosses the paper. The software listens for these pulses and only prints a dot when it receives a pulse.

To the Z80 in the ZX81 the printer appears as a single input/output port located at #FB. (# in Atom Basic means hex.) Z80's have separate I/O addressing and when the $\overline{\text{IORQ}}$ line is taken low it means that the CPU wants to access an I/O port and not a memory location. The address of this port is given by the lower eight bits of the address bus. Sinclair has cheated a bit here and uses only A2, instead of decoding all eight, which has the advantage that you only have to take $\overline{\text{IORQ}}$ and A2 low (0v) to enable the printer. The Atom has a 6502 which doesn't have separate I/O addressing but it's simple to wire the printer as a normal memory location using NB400 on PL8. NB400 is a ready-decoded, active low, enable line intended for the Econet interface – so if you are using Econet you will have to locate the printer elsewhere.

Figure 1. (a) Table shows connections between Atom and printer
(b) ZX printer connection from computer's side
(c) PL6 Eurocard connector from behind Atom

Pin on ZX connector	Description	Pin on PL6	Description
A4	D0	a23	D0
A5	D1	a22	D1
A6	D2	a21	D2
A7	D6	a17	D6
A1	D7	a16	D7
A16	$\overline{\text{RD}}$	a5	NRDS
A17	$\overline{\text{WR}}$	a4	NWDS
A15	$\overline{\text{IORQ}}$	b24	NB400
B9	A2	a32	0V
B4	0V	a32 and PSU	0V
B1	5V	a1	5V
B2	9V	to PSU	—

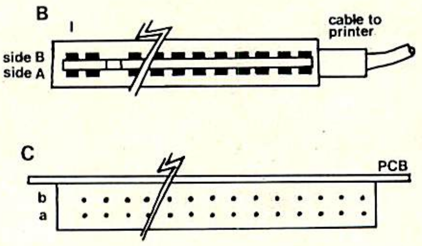
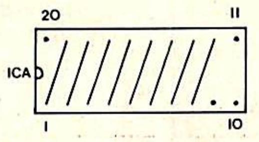


Figure 2. Position of wire links to replace IC4



Two other Z80 control lines are needed by the printer, $\overline{\text{RD}}$ and $\overline{\text{WR}}$. $\overline{\text{RD}}$ is taken low to read from a location and taking $\overline{\text{WR}}$ low causes the data on the bus to be written to a location. The atom has two similar signals called NRDS and NWDS generated on board. (Respectively they mean 'not read data strobe' and 'not write data strobe'.) The rest of the wires to the printer are five data lines and three power (0v, 5v and 9v). The data lines have the following functions;

- D0 is a signal from the encoder disc in the printer which sends a pulse at each dot position so successive scans can be made to line up.
- D1; when the motor is on a 1 in this bit makes the motor run at a slower speed.
- D2; 1 = turn motor off, 0 = turn motor on.
- D3, D4 and D5 are not used.
- D6 is always low and indicates the printer is connected.

D7 serves two functions. When used

as an output it controls the stylus, a 1 causes a current to flow through the stylus and produce the dot. When used as an input it indicates when the stylus hits the edge of the paper.

One of the faults of the ZX printer is the rather cumbersome connector which mounts between the ZX81 and the RAM pack. Even more annoying is the incredibly short length of cable between it and the printer. Unless you are prepared to invalidate the guarantee by removing this connector you will have to purchase a 23-way edge connector to mate with it. Wires soldered to this can then be taken to the Atom's eurocard bus which appears on PL6. You can either solder them directly to the PCB or use the proper eurocard plug and socket. The pin to pin connections are shown in figure 1. Only one wire cannot go to PL6 and that is the 9v which must come from the power supply included with the printer. Again, use a 3.5mm jack socket so you don't ruin the PSU and invalidate the guarantee.

Figure 1 indicates that NB400 is on pin 24b of the eurocard bus. In fact on a normal Atom this pin is unused so to make it available here you should solder a piece of wire from pin 4 on PL8 (see the Atom hardware manual) to pin 24b on the eurocard bus PL6. This allows the NB400 signal to enable the printer when it is linked to the IORQ. Note that A2 isn't needed any more, but it must be tied to 0v.

The data lines on PL6 are not actually present unless IC4 is plugged in. IC4, the data bus buffers, is not supplied even with the fully expanded Atom, but as the printer doesn't present much of a load to the 6502's data bus it can be replaced by wire links as in figure 2. (Even if you do have IC4 in your Atom you can't use it because it won't be enabled by NB400.)

The printer now appears as a single memory location at B400 and if you have connected it up properly typing ?#B400=4 should cause it to burst into action. Type ?#B400=0 to stop it again.

Program 1 controls the printer. It provides two functions the first of which is to take all the characters sent to the Atom's VDU and send them to the printer as well, so you can have hard copies of listings and program runs. Second, it can dump the whole of the graphics mode 4 onto the printer inversing it if required.

The first part is achieved by changing the address of the write character routine (OSWRCH), normally set to #FE52, to the address of the new routine. This is possible because the Atom uses vectors, that is many of the operating system routines' addresses are stored in zero page memory and the operating system looks at these first to see where to jump.

By storing a new address in these locations any user-written routine can be 'patched' into the operating system.

The patched-in routine starts at LL20 and its first job is to check for the new control codes. Control B will enable the printer and control C will disable it. Their actual effect is to change what is stored in location #FE, a flag to indicate whether the printer is enabled or not. It then prints the character to the VDU by calling the subroutine at #FE55. After that it tests to see whether the printer is enabled and if it is, *it jumps to the*

Program 1

```
>L.
   10 REM PRINTER CONTROLLER
   20 DIM LL40
   22 FORJ=0TO40;LLJ=#3400;N.
   25 D=#B400
   30 FORJ=0TO1;P.$21;P=#3780
   40[\MAKE PATCH
   45:LL40LDA@LL20%256;STA#208;L
DA@LL20/256;STA#209;RTS
   46\PRINT LINE
   50:LL0LDA@2;STAD;LDA@0;STA#70
;STA#73;JSRLL2
   60:LL1JSRLL2;LDX@0
   70:LL3LDA#21C,X;CMP@10;BEQLL4

   75 STA#71;LDA@0;STA#72;LDY@3
   80:LL5ASL#71;ROL#72;DEY;BNELL
5
   90 LDY#70;CLC;LDA#72;ADC@#38;
STA#72;LDA(#71),Y;STX#75;JSRLL6
  100 LDX#75;INX;CPX@32;BNELL3
  110:LL4INC#70;LDA#70;CMP@8;BNE
LL1;LDA@4;STAD;RTS
  120\MARGIN
  130:LL2LDA@2;STAD
  150:LL9LDAD;AND@#80;BEQLL9
  155:LL30LDAD;AND@1;BEQLL30;LDA
@2;STAD;RTS
  160\PRINT BYTE
  170:LL6STA#74;LDA#73;BEQLL10;L
DA#74;EOR@#FF;STA#74
  180:LL10LDX@7
  190:LL11LDY@1;LDA#74;AND@128;B
NELL12;LDA@130;STAD;JSRLL14
  200 LDA@2;STAD;JMPLL13
  210:LL12LDA@2;STAD;JSRLL14;LDA
@2;STAD
  220:LL13ASL#74;DEX;BPLLL11;RTS
  230\WAIT FOR PULSE
  240:LL8LDA@2;STAD
  250:LL14LDAD;AND@1;BNELL14
  260:LL15LDAD;AND@1;BEQLL15;RTS

  270\NEW OSWRCH
  280:LL20STA#23F;CMP@2;BEQLL21;
CMP@3;BEQLL22;LDA#23F;JSR#FE55
  285 PHA;PHP;TXA;PHA;TYA;PHA
  290 LDA#FE;BEQLL23;PLA;TAY;PLA
;TAX;PLP;PLA;RTS
  300:LL21LDA@0;STA#FE;STA#23C;R
TS
  310:LL22LDA@16;STA#FE;RTS
  320:LL23LDA#23F;CMP@10;BEQLL26
;CMP@32;BMILL25
  325:LL26LDY#23C;STA#21C,Y;CMP@
10;BEQLL24
  330 INC#23C;LDA#23C;CMP@32;BEQ
LL24;:LL25PLA;TAY;PLA;TAX
  335 PLP;PLA;RTS
  340:LL24LDA@0;STA#23C;JSRLL0;P
LA;TAY;PLA;TAX;PLP;PLA;RTS
  350\COPY MODE 4
  355:LL34LDA@1;JMPLL31+2
  360:LL31LDA@0;STA#73;LDA@#80;S
TA#7B;LDA@0;STA#7A;LDA@2;STAD
  370:LL32LDY@0;JSRLL2
  380:LL33LDA(#7A),Y;STY#7C;JSRL
L6;LDY#7C;INY;CPY@32;BNELL33
  390 LDA#7A;CLC;ADC@32;STA#7A;L
DA#7B;ADC@0;STA#7B;CMP@#98
  395 BNELL32;LDA@4;STAD;RTS
  400]
  410 N.;P.$6
  430 END
```

Listing 1.

Program 2

```
>L.
  10 REM CHARACTER SET LOADER
  20 PRINT$12"  PLEASE ENTER D
ATA IN HEX.YOU"
  30 PRINT"DO NOT NEED TO PRESS
RETURN";
  40 PRINT"AFTER EACH NUMBER.I
WILL BEEP";
  50 PRINT"AT THE START OF EACH
LINE.IF YOU"
  60 PRINT"MAKE A MISTAKE PRESS
'M'.""
  70 GOSUB m
  80 A=0;@=0
  90 FORJ=#3900 TO #3BFF
 100 GOSUB k
 110 IF J>#3900;IF A=77;G.e
 120 N=A
 130 GOSUB k
 140 IF A=77;P.$8$32$8;G.100
 150 N=N*16+A
 160 P." "
 170 ?J=N
 180 IF J%10=1;P.'$7
 190 NEXT
 200 T=0
 210 FORJ=#3900 TO #3BFF
 220 T=T+?J
 230 NEXT
 240 IF T<>181778;P.'"ERROR IN
DATA ENTRY"';END
 250 P.'"DATA ENTERED CORRECTLY"
 260 END
 270kLINK K
 280 IF A=77 G.330
 290 IF A<48 OR (A>57 AND A<65)
OR A>70 G.k
 300 A=A-48
 310 IF A>16 A=A-7
 320 P.&A
 330 RETURN
 340mP=#28C0
 350 K=P
 360 P.$21
 370[JSR#FFE3;STA#322;RTS
 380]
 390 P.$6.
 400 RETURN
 410eIF J%10=2 P.$8$8
 420 P.$8$8$32$8$8$32$8;J=J-2;G
.190
Listing 2.
```

send character routine LL23, otherwise it returns from OSWRCH. Printing characters on the printer is not as simple as sending them one by one because the ZX printer can only deal with whole lines at a time. Instead each character that is to be printed is stored in a 32-character software buffer starting at #21C (free locations on the Atom) which is only printed out either when the buffer is full or when it receives a carriage return character.

Printing the contents of the buffer is done by LL0. As the characters are formed on an eight-by-eight dot matrix, eight scans of the stylus are required for each line. However to make it more legible I have added on extra blank scan between each line. On a single scan it takes successive characters from the buffer and uses their ASCII code to find their position in the table. This table is a series of bit patterns and each byte in the table defines one row of the matrix which means that eight bytes are required to store one character's definition. The Atom has 64 ASCII characters (128 if you include inverse characters) but I

continued on page 62 ▶

Program 3

```
FF FF FF FF FF FF FF FF F7 F7
F7 F7 FF FF F7 FF EB EB EB FF
FF FF FF FF EB EB C1 EB C1 EB
EB FF F7 E1 D7 E3 F5 C3 F7 FF
CF CD FB F7 EF D9 F9 FF F7 EB
EB E7 D5 DB E5 FF FB F7 EF FF
FF FF FF FF FB F7 EF EF EF F7
FB FF EF F7 FB FB FB F7 EF FF
FF F7 D5 E3 D6 F7 FF FF FF F7
F7 C1 F7 F7 FF FF FF FF FF FF
FF F7 F7 EF FF FF FF C1 FF FF
FF FF FF FF FF FF FF F7 F7 FF
FF FD FB F7 EF DF FF FF E3 DD
D9 D5 CD DD E3 FF F7 E7 F7 F7
F7 F7 E3 FF E3 DD FD FB F7 EF
C1 FF C1 FB F7 FB FD DD E3 FF
FB F3 EB DB C1 FB FB FF C1 DF
C3 FD FD DD E3 FF F3 EF DF C3
DD DD E3 FF C1 FD FB F7 EF EF
EF FF E3 DD DD E3 DD DD E3 FF
E3 DD DD E1 FD FB E7 FF FF FF
F7 F7 FF F7 F7 FF FF FF F7 F7
FF F7 F7 EF FB F7 EF DF EF F7
FB FF FF FF C1 FF C1 FF FF FF
EF F7 FB FD FB F7 EF FF E3 DD
FB F7 F7 FF F7 FF E3 DD D1 D5
D1 DF E3 FF E3 DD DD C1 DD DD
DD FF C3 DD DD C3 DD DD C3 FF
E3 DD DF DF DF DD E3 FF C7 DB
DD DD DD DB C7 FF C1 DF DF C3
DF DF C1 FF C1 DF DF C3 DF DF
DF FF E1 DF DF D9 DD DD E1 FF
DD DD DD C1 DD DD DD FF E3 F7
F7 F7 F7 F7 E3 FF E1 FB FB FB
FB DB E7 FF DD DB D7 CF D7 DB
DD FF DF DF DF DF DF DF C1 FF
DD C9 D5 D5 DD DD DD FF DD DD
CD D5 D9 DD DD FF E3 DD DD DD
DD DD E3 FF C3 DD DD C3 DF DF
DF FF E3 DD DD DD D5 DB E5 FF
C3 DD DD C3 D7 DB DD FF E1 DF
DF E3 FD FD C3 FF C1 F7 F7 F7
F7 F7 F7 FF DD DD DD DD DD DD
E3 FF DD DD DD DD DD EB F7 FF
DD DD DD D5 D5 D5 EB FF DD DD
EB F7 EB DD DD FF DD DD DD EB
F7 F7 F7 FF C1 FD FB F7 EF DF
C1 FF E3 EF EF EF EF EF E3 FF
FF DF EF F7 FB FD FF FF E3 FB
FB FB FB FB E3 FF F7 EB DD FF
FF FF FF FF FF FF FF FF FF FF
FF C1 DF EF F7 FF FF FF FF FF
FF FF E3 FD E1 DD E1 FF DF DF
DF C3 DD DD C3 FF FF FF F1 EF
EF EF F1 FF FD FD FD E1 DD DD
E1 FF FF FF F3 ED E1 EF F3 FF
FB F5 F7 E3 F7 F7 F7 FF FF FF
F3 ED ED F1 FD F3 EF EF EF E3
ED ED ED FF FF F7 FF E7 F7 F7
E3 FF FF FB FF FB FB FB EB F7
EF EF EF EB E7 EB ED FF E7 F7
F7 F7 F7 F7 E3 FF FF FF EB D5
D5 DD DD FF FF FF F3 ED ED ED
ED FF FF FF F3 ED ED F3 FF FF
FF FF E3 ED ED E3 EF EF FF FF
E3 DB DB E3 FB F9 FF FF E9 E7
EF EF EF FF FF FF E3 DF E3 FD
E3 FF FF F7 E3 F7 F7 FB FF FF
FF FF DB DB DB DB E1 FF FF FF
DD DD DD EB F7 FF FF FF DD DD
D5 D5 EB FF FF FF F7 EB F7 EB
DD FF FF FF ED ED ED F1 FD F3
FF FF C1 FB F7 EF C1 FF F9 F7
F7 CF F7 F7 F9 FF 00 FF FF FF
FF FF FF FF CF F7 F7 F9 F7 F7
CF FF FF FF EF D5 FB FF FF FF
D5 EB D5 EB D5 EB D5 EB

Listing 3.
```

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RED BLUE AND GREEN – THE BIG SORT OUT

Paul Beverley unravels the colours for frustrated Atomists with TTL monitors

Colour monitors which take separate TTL inputs for red, green and blue are becoming much more common.

So it is frustrating for Atom owners with access to these monitors to find the Atom colour card only giving a UHF signal for a colour television.

So how can the signals be taken directly from the VDU driver chip (6847 – designed originally for use with an American colour system) and be decoded into separate colour signals?

The main part of the circuit provides signals for the four logical colours of the Atom's colour display (figure 1).

To translate these into actual colours, and to produce the red, green and blue signals, you will need one or more of the other three circuits (figures 2-4).

Figure 5 shows three possible arrangements of these circuits.

One produces the standard Atom colours (red, green, blue and yellow).

The second choice is to use a patch panel, so the required combination of colours for each of colours 0 to 3 can be selected.

And the most complex circuit gives a choice of either the standard set of Atom colours, or a set which can be selected on the patch panel. You can also switch between the two colour sets by using one of the spare output lines on the 8255 adapter, eg PC3.

The heart of the whole decoding system consists of three main parts represented by the three integrated circuits (figure 1) IC1 takes the three colour signals oA, oB and CB, and decodes them to a two-bit binary number. This is turned into four individual lines, one for each colour, by the two to four line decoder, IC3.

The halves of IC2 take the *composite video* signal and, by comparing it with two different levels, produce fly-back blanking and a synchronisation signal.

The synchronising signal is positive-going, but if a negative-going signal is needed, you can either invert it by using a spare TTL gate, or reverse the connections to pins 9 and 10 – on IC2, the positive and negative inputs to the

Figure 1. Main decoding circuit.

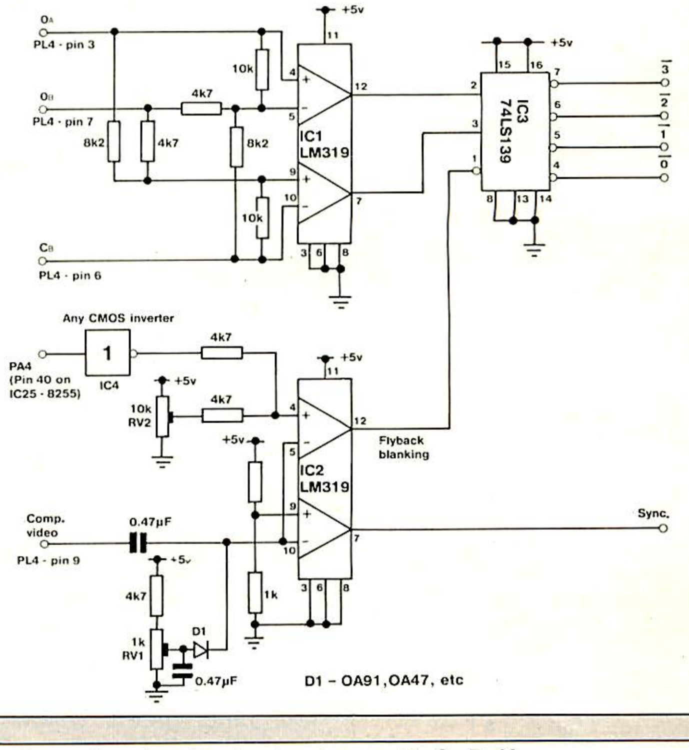


Figure 2. Decoding for standard colours – R, G, B, Y.

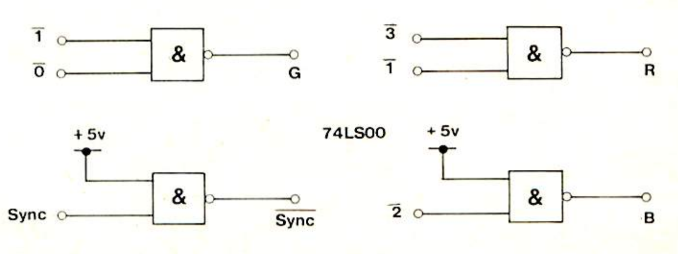


Figure 3. Buffering for colours 0,1,2,3 plus colour selection

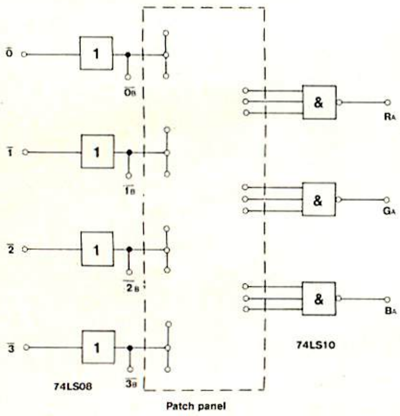


Figure 4. Switching circuits – standard/patch panel colours

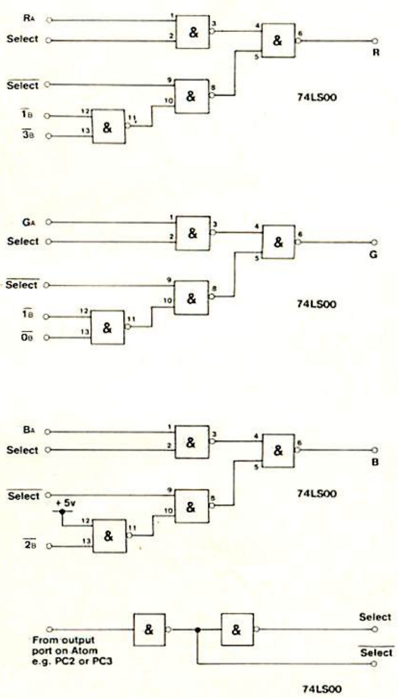
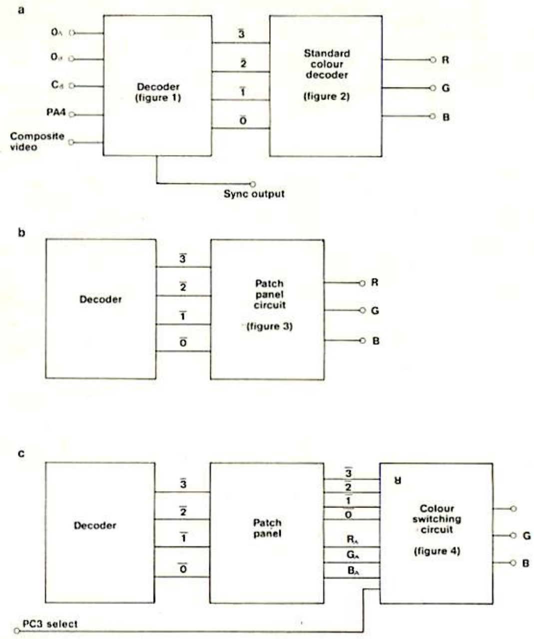


Figure 5. Possible circuit arrangements. (a) standard Atom colours (b) selection of colour combinations (c) colour set selection



comparator.

Adding the output of PA4 from the adapter to the blanking circuit is not absolutely necessary, but blanks the screen in text-only modes. To get the blanking occurring at the correct level, a pre-set is provided to set the current level. The other pre-set adjusts the level for the synchronising pulses.

Figure 2 shows the simplest colour selection circuit. It produces green for colour 0, yellow for colour 1, blue for colour 2, and red for colour 3. If you use a 74LSOO for this, it leaves a single gate which can be used as an inverter/buffer for the synchronising signals if needed.

The idea of the patch panel (figure 3) is that any of the colours 0 to 3 can be connected to any or all of the three gun colours, so each of the four logical colours could be given an actual colour of red, blue, green, yellow (R + G), cyan (B + G), magenta (R + B), or white (R + B + G).

They could even produce black by being left unconnected. And figure 4 shows how to change from the standard colour set (G,Y,B,R) to the set selected by the patch panel.

The construction of this unit is straightforward. Because of the high frequencies involved, the circuits ought to be built on good quality circuit boards, but the prototype was buillt on standard 0.1" Veroboard and appeared to work.

So it seems unnecessary to go to the trouble of producing a board for just one circuit. Most connections needed are available on various connectors on the back of the Atom, the only exception being PA4 of the adapter which has to be taken directly from pin 40 of the 8255.

There is plenty of room on the back of the Atom case to put a single socket of some sort to make the unit detachable. But if you build the unit neatly it could be mounted inside the case, the output to the monitor being put onto a multi-way connector such as a 6-way din socket as used on the BBC microcomputer.

To use PC3 for selection of colour sets, you will have to break link 5 on the Atom board to disconnect it from the 6847 video generator.

This is the only disadvantage – the Acorn PAL encoder, being analogue and not digital, allows you to use the 6847's alternate colour set by changing PC3.

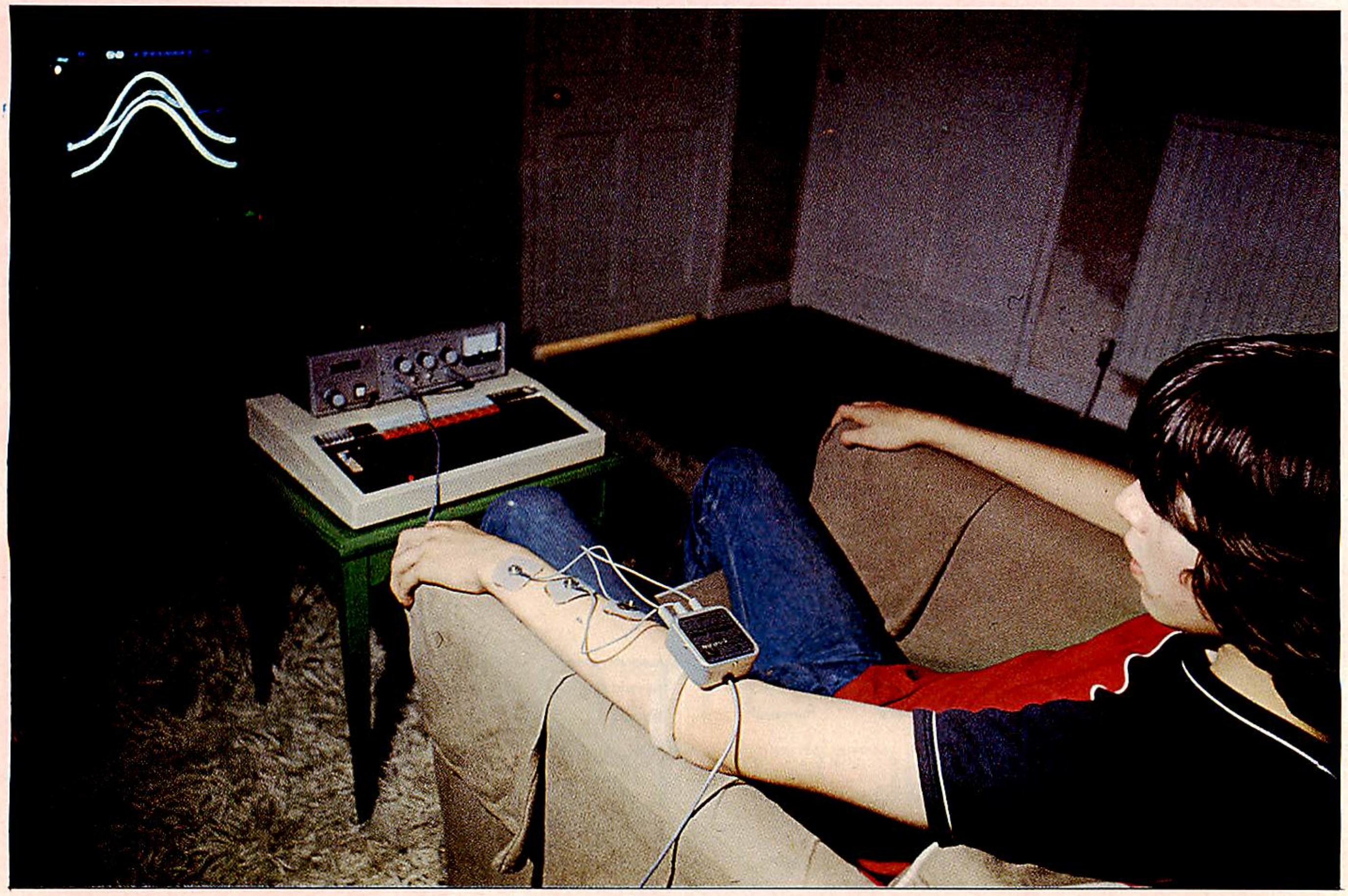
Although you can get cyan and magenta, there is no way with a simple on-off system like this to mimic the 6847's buff and orange colours.

FIGHTING BACK IN A WAR OF NERVES

Laurence van Someren describes how being wired up to a BBC micro (below) can help people overcome nerves, coordinate muscles, and even lower their blood pressure without using drugs.

'Biofeedback means connecting a person to a 'black box' to make him more aware of what is going on in some part of his body, so he can control that part better. This may be a chronically tense muscle, or something usually thought of as involuntary, such as blood pressure or the level of nervous tension.

One biofeedback instrument is the Relaxometer which is attached by leads to two fingertips. It makes a sound which varies in pitch. As you doze off the pitch drops to a buzz and dies away, but if something startles you or you think about something worrying or exciting the tone rises to a scream.



It may sound trivial, but there are many people who know they are tense and cannot relax, and others who don't know they are tense until they end up telling a doctor about constant headaches, or back pains.

The Relaxometer tells people when they relax. The tone gives them immediate feedback and helps them learn what makes them tense, and then what makes them relax. They can practise relaxing in situations that make them tense, and eventually learn to cope with their tension in more and more situations, even public speaking or flying.

The instrument measures the electrical resistance of the skin, because when you panic you break out in a sweat which decreases the skin's electrical resistance drastically. But even without panic, changes of this sort happen all the time.

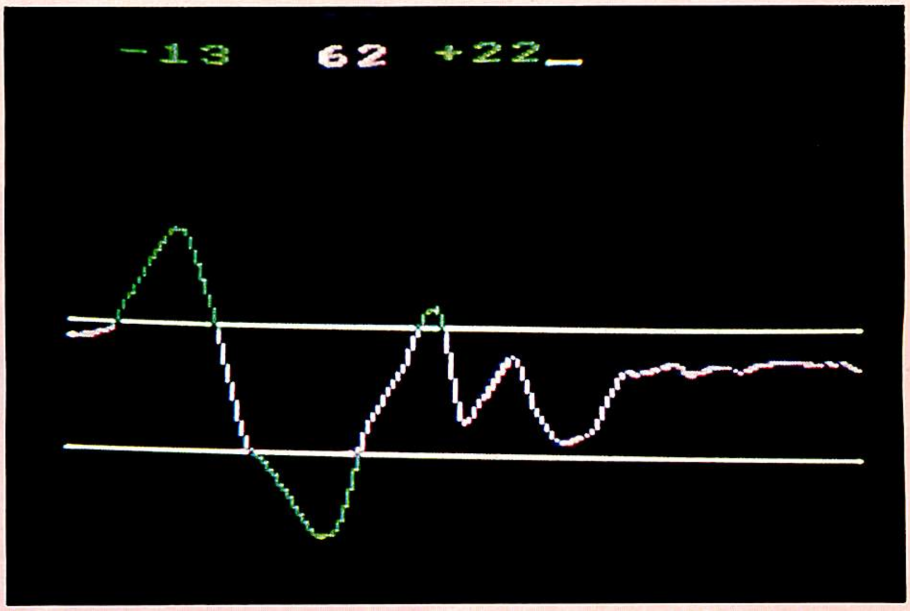
The Relaxometer picks up these small changes, amplifies them and translates them into sound.

People who have benefitted from such feedback training include those with high blood pressure. They often have a marked response to stressful situations, and training to reduce their responsiveness can control blood pressure without the use of drugs.

It is simple to take the voltage output from the Relaxometer and use the A/D input port of the BBC model B to convert the signal to a visual display – say a spot which moves across the screen rising or falling as you tense or relax.

Another established technique is myoelectric feedback. Here, electrodes on a muscle group pick up the electrical activity which occurs when the muscle contracts and translate the signal into sound or a meter reading. Patients suffering from chronic headaches caused by tension in the forehead muscles, use the feedback signals to learn how to relax those muscles, and relieve the headaches.

Some years ago people tried this method with spastics who have chronic and uncontrollable tension in many of their muscles. Useful progress was made, but when they tried to make a deliberate action and tense the muscle, it became uncontrollable again. So simple feedback aimed at teaching relaxation was not enough. What was needed was a technique to teach coordinated action involving several muscles.



Myoelectric feedback. . . muscle control keeps trace between target lines

This is where the microcomputer comes in, as it can give more complicated feedback which can be adjusted to suit the needs of the particular patient. And we can vary the type of feedback.

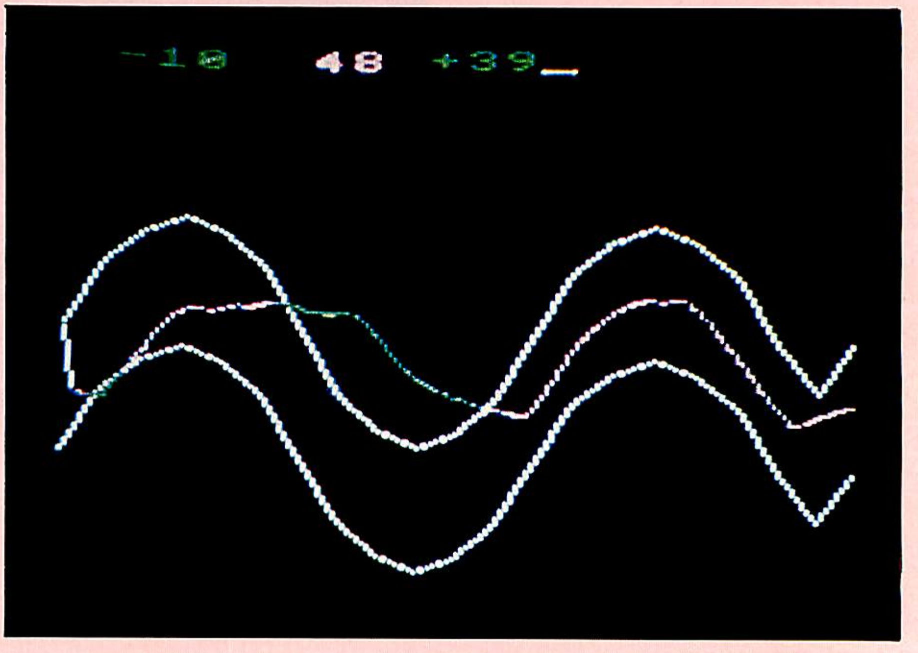
You like video games? We offer you *Breakout* with a paddle controlled by a muscle, or *Defender* where you get blown up if you lose your cool. You like a detailed scientific presentation? We can offer you a graph of performance versus time with a display of scores on target, above target and below target in the last trial.

But coming back out of the realm of fantasy, the point about using a microcomputer is to tailor the task and the feedback to the patient, and keep records. Most important of these features, however, is flexibility. If the program is written well, even someone who is scared of computers can change the type of feedback, or the difficulty of the task, between tests.

Work is only beginning in this

Bell-shaped curve pattern demands close control

Narrower, more tortuous targets, higher tension and a faster screen trace can all be varied to make the control task harder. Scores at the top of the screen refer to the last attempt.



area, with the collaboration of a special school for spastics and other children in Cambridge. Software is under trial with myoelectric feedback instruments, a BBC model B and a TV set.

Voltage feedback varies the vertical position of a dot which moves across the screen at a chosen speed. So if you want visual feedback of general arousal from a Relaxometer you set the *scale* to a low number and the spot moves fairly slowly – say 30 seconds to cross the screen. (Arousal level changes don't occur as fast as muscle tension changes.) Then you work on getting the spot down to the bottom of the screen – and if someone shouts at you the trace will jump up and you have to work to get it down again.

To relax a particular muscle, you choose the appropriate section of the program and again use a slow trace and work on getting it down. For a bigger challenge you call up a *target* pattern. The simplest is a pair of parallel lines across the screen. Then you try to keep the spot between the two lines. At the end of the screen there is a short delay, to 'get your breath back', and the percentage time in, below and above the target appear on the screen. One of the specified parameters is the line spacing (closer makes it harder). The other is their distance from the foot of the screen, which says how hard you have to tense the muscle to get into the target range.

The task can be made harder by choosing a higher tension, or demanding better control of tension by setting a narrower target. The speed at which the spot moves can also vary.

But the target does not have to be a constant tension; it can vary in a sine wave or a bell-shaped curve. So a relatively difficult task will require a muscle tension level which will rise and fall twice within narrow limits in five seconds.

These changes are easy for the user to make. Questions are posed on the screen and replies made by key entries to select:

- Type of feedback (relaxometer or myoelectric).
- Speed of traverse (number from 1 to 31).
- Target shape (function keys).
- Centre of target (height from screen base, 1 to 1023).
- Width of target (1 to 1023 units).

RUN makes the spot start moving, and it repeats after a short delay at the end of each screen. ESCAPE gives you the questions again.

Each screen of data can be stored on disc with the relevant parameters and patient data, for review at the end of a session. These can be printed out and kept for comparison, or held on disc.

This system will not have spastic patients leaping from their wheelchairs and taking up the violin, but evidence suggests it is worth evaluating more sophisticated forms of feedback. And if patients benefit, we can jump back into the realms of fantasy, or at least informed speculation, and think about a portable myoelectric unit (already available) and an EPROM with target patterns on it. Controls choose which target and how fast, and in one headphone there is a rising and falling target tone. The other ear feeds back your actual performance, so you try to match the two ears, which is only done if you are walking with a smooth gait.

A physiotherapist I know uses this to help patients with broken legs, but at the weekends she takes it down to the tennis court and works on developing a more powerful service.

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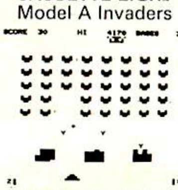

Actual screen photo

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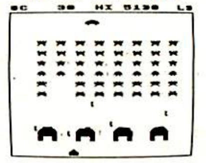

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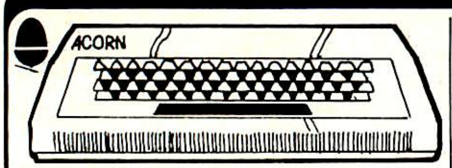

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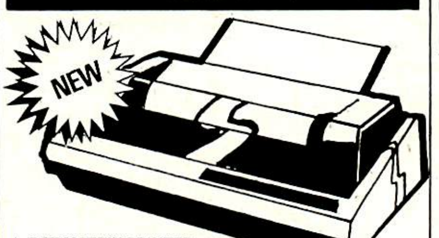

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BBC Service & Information Centre.

Software worth £20 awaits the winner of this month's competition. But first, Simon Daly explains what kite-flying, salami and the Trojan Horse have in common

Computer crime

Most of us like to watch films about bank robberies – and often find ourselves siding with the villains. And in the same way, 'computer crime' exercises a curious fascination for many.

The press is particularly fascinated: a multi-million pound swindle has always been inherently more interesting than a Ford Cortina break-in, and if the fraudsters can be allied with computers, all the ingredients are there for a front-page sensation.

A few years ago in London an elaborate 'kite-flying' exercise was mounted against certain banks. Kite-flying, in its simplest form, is when a crook opens accounts at two banks and passes cheques between them.

The cheques get bigger and bigger as the money gets no more real. But because of the time it takes for the cheques to clear everything appears above board.

'The cheques get bigger and bigger'

Finally the criminal draws two massive cheques and decamps with someone else's hard cash.

The London operation was particularly complicated, and involved many accounts and operators.

The mastermind behind it leased a computer to keep track of all the accounts, and his accomplices would ring him daily for their stored instructions.

Alas, poor mastermind! The program crashed at the height of the swindle. Two days later the banks discovered something wrong and called in the law.

The police found Mr Big in the bleary-eyed state which will be familiar to many of you – he had spent the interveneing 48 hours without food or sleep in a desperate attempt to locate the bug!

The point of this tale is that without the computer the case would have attracted little interest. What had been dubbed a 'computer crime' was little more than a common if elaborate swindle in which a computer was used to make calculations. Most cases of 'computer crime' fit this category.

What is commonly described as the largest-ever computer fraud took place in the US in the early seventies.

The directors of a flashy life insurance compnay became greedy and invented a multitude of non-existent clients, which they stored on their computer; they then sold off the policies to other insurance companies.

This swindle reaped millions before it came crashing down. But what enabled it to take place at all was that the conned companies failed to question the computer output.

'Gigo' is notorious in the computer industry: garbage in, garbage out!

But even if all computer crime is only a variation on traditional human activity, there is no doubt that computers offer exciting opportunities to determined thieves.

Because relatively few people even begin to program a computer, let alone understand someone else's program, the high priests of this new technology have exceptional chances of making crime pay. And computer programmers are as open to temptation as the next man in a white collar.

The best-known and commonest form of computer crime is 'rounding-down'.

This fraud is sometimes called the 'salami technique', because it entails taking many miniscule slices, none of which is noticeable on its own but all of which, taken together, add up to a lot of baloney.

In essence, it involves siphoning off tiny amounts of money into an account belonging to the perpetrator or an accomplice. You can set up a crude version of the fraud on your own micro in the following manner.

'Companies failed to ask questions'

Dimension is a numerical array of 5000 elements called 'Customers' and use the pseudo-random number generator to fill them with values between, say, 1 and 10,000. You now have your own branch of a typical High Street bank or building society. The numbers in the array represent the amount in each customer's account. Let us assume that Customer 5000's account is your own. You now proceed to rob your clients by crediting each account with, say,

Test your graphics skill

This month's competition invites you to put your graphic abilities to the purposes of forgery – just draw a banknote on the VDU (any denomination will do). In the case of BBC programs, please submit a cassette containing at least two copies of the program. Make sure the cassette has your name and address and enclose a SAE if you want it back. Contestants submitting programs for other micros are asked to send a photograph of the results together with a listing.

The best three entries will receive £20-worth of Acornsoft packages. Entries to Competition Editor, Acorn User, 53 Bedford Square, WC1B 3DZ.

Solutions to arrive no later than October 25.

1.7 per cent interest. This could be quarterly, weekly or some other form of interest.

Truncate the amount in each account to two decimal places to represent the pence – and that's what the customer will see on his statement.

But a computer, of course, works to far more decimal places.

If a customer's credit is £85.47 then the interest will be £1.45. But the 1.7 per cent of £85.47 is £1.45299.

In an honest system the difference – .299 of one new penny – will be distributed to other customers. But in your system you stick it into Customers (5000). The bank believes the books still balance.

Make the computer continue in this fashion and run through all the accounts several times.

Take a 30 minute tea break – it's surprising how much your own account will have swelled with these amounts by the time you return!

In practice, any competent audit will soon spot a fraud as crude as this. More subtle refinements of the basic principle, though, often come to light.

A more delicate form of fraud is the so-called 'Trojan Horse' technique. The principle is that embedded in some enormously lengthy and complicated program is another program, specifically designed to do something not intended by the main program.

A rather good thriller has been written on this theme.* It postulated a large bank dependent on its computers. At midnight every night a program would come down the phone line from the Manchester Data Centre to the London HQ and update all the customers' records.

What the bank didn't know was that sitting in this program was something dubbed 'the weevil', which instantly set about its thieving – probably a variation on the 'salami' fraud – and then scuttled back to Manchester.

While the fraud expert was tearing the London computer to pieces the criminal evidence was sitting pretty up north!

'Information can become a target for the thief'

Another fraud which puts fear into the vaults of banking fraternity is known as the 'logic bomb'.

However hard you scrutinise the programmers and their programs, it can be very difficult to detect a machine code instruction to the computer to pay £5 million two years hence into an account in Rio de Janeiro, or somewhere else without extradition treaties, where the culprit plans being at that time.

But computer crime is not always connected directly with money. As computers are used increasingly to store vast amounts of sensitive information, so this can also become a target for the thief. Three years ago, during the unsavoury affair which cost Ladbrokes its casino licences, it transpired the company had been bribing at lease one policeman 50 pence a time to use a force computer to check out the names and addresses of owners of cars parked outside premises, – presumably so new business could be solicited.

The Thames Valley Police computer is now said to contain information, much of it speculative, on over one in seven of people in the area.

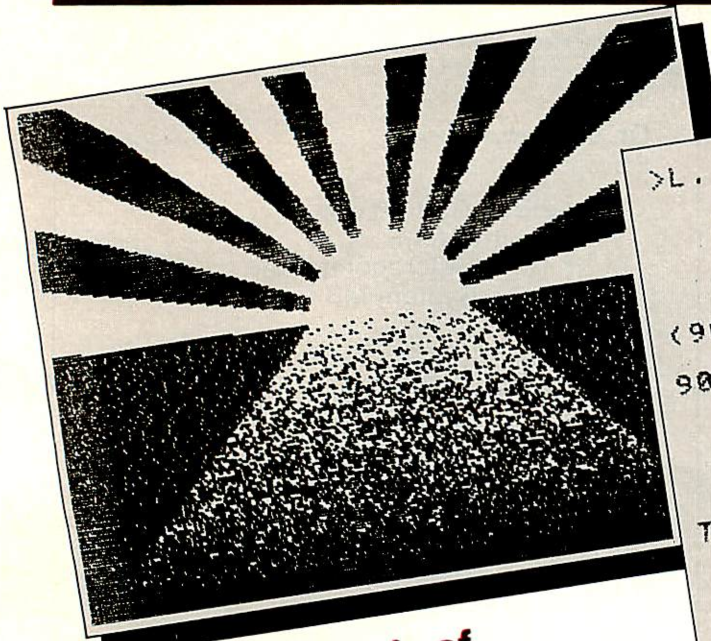
Even if you accept that the police force is an essentially benign organisation, it isn't surprising that civil liberties groups, among others, are uneasy about a situation arising where the individual has no right to see his own record.

These problems are certain to become increasingly pressing, and as computers proliferate – together with the number of people who have access to them – so will the ways in which they can be used illegally.

One security specialist told me recently: 'What scares me is that so far less than 10 per cent of all known computer fraud was uncovered because someone was looking for it – the rest came out through pure accident or confessions.

'What's going on with all the computer crime we don't know about?'

**The Consultant,* John McNeil, Futura.



```
>L.
   10 REM Sunset
   30 CLEAR4
   70 REM Sun
   80 FOR Y=0 TO 29
   90 MOVE 128,(96+Y);PLOT1,-SQR
(900-Y*Y),0
  100 MOVE 128,(96+Y);PLOT1,SQR(
900-Y*Y),0
  110 NEXT Y
  120 REM Reflection
  130 FOR Y=95 TO 0 STEP -1
  140 FOR X=Y+3 TO 253-Y
  150 IF ABSRND%10<Y/10 THEN PLO
T13,X,Y
  160 NEXT X
  170 FOR X=0 TO Y+10
  175 X=X+4+ABSRND%6
  180 IF ABSRND%10<Y/10 THEN PLO
T13,X,Y
  190 IF ABSRND%10<Y/10 THEN PLO
T13,(255-X),Y
  200 NEXT X;NEXT Y
  210 REM Rays
  220 FOR Y=95 TO 0 STEP-1
  230 FOR T=1 TO 91 STEP 20
  235 %T=TANRADT
  250 MOVE%(127-Y/%T),(Y+96)
  260 DRAW%(127-Y/(TANRAD(T+10))
),(Y+96)
  270 MOVE%(128+Y/%T),(Y+96)
  280 DRAW%(128+Y/(TANRAD(T+10))
),(Y+96)
  290 NEXT T;NEXT Y
  300 END
```

A simple example of printed Atom graphics using the article by Matthew Bates on page 36.

July Competition Winners

Readers were invited in Issue One to submit programs to deal a pack of cards and to simulate the throwing of the dice in the Waddington's game of *Risk*. The competition produced a torrent of entries, many of which were of outstanding quality.

Commiserations to those who know they wrote brilliant programs, but haven't won! It wasn't easy and few people who tackled it got the question of the odds at *Risk* correct. In a nutshell, there are 7,776 different combinations of the dice. On 2,275 occasions the attacker will lose two armies, on 2,890 the defender will lose two. The rest of the time they lose one each. The odds therefore favour the attacker significantly. This confirms what I always thought when I used to play the game. If you believe someone is going to attack, you should get your own attack in first even if you have a smaller army – at least you can use the odds to make your enemy's losses greater.

It might have looked easy. . .

Attacker dice throw	Defender dice throw	Result
6,4,4	6,4	Attacker loses 2
6,4,4	6,3	Both lose 1
6,4,4	5,3	Defender loses 2

After weeding out those with bugs, those which were illiterate (I grew tired of seeing 'Attacker looses two armies'), and those which lacked imagination, we were left with a hardcore of some 30 talented programs. The winners (chosen with the aid of a bloodthirsty 13-year-old cousin and a long-suffering girlfriend who hates computers but loves cards) were as follows:

Russell Ward, 30(a) Fairholme Rd, London W14
W.S. Powell, 22 Broadland Close, Kingswinford, W. Midlands
R.W. Martin, 82 Willmot Road, Sutton Coldfield, W. Midlands
P.J. Beaven, 73 Waterloo Rd, Crowthorne
M.W. Case, 109 Ferry Rd, Hullbridge, Hockley, Essex
Joan New, 26 Wardo Avenue, London SW6
R.W. & E.D. Prager, Old School House, Elsleck, Skipton, Yorks
R.A. Scott, 22 Tabley Close, Knutsford, Cheshire
S.A. Mills, 17 Rounton Rd, Church Crookham, Fleet, Hants
M. Sein (Address not supplied – please let us know!)

Their names are now being added to our computer mailing list for a year's free subscription to *Acorn User*.

Malcolm Hall looks at three likely-looking texts for beginners

DIY Basic trio

- *Basic Programming on the BBC Microcomputer by Neil Cryer and Pat Cryer, Prentice Hall, 195pp, £5.95*
- *Let your BBC Micro teach you to program by Tim Hartnell, Interface, 193pp, £6.45*
- *BBC Microcomputer System User Guide, by John Coll, BBC, 518pp*

As has happened with many other micros, books on the BBC micro are now swarming into the shops.

Leaving the *User Guide* to later since it is part of the BBC microcomputer package, I will concentrate on the other two, which are aimed at the beginner who has just received a BBC micro and wishes to learn how to program. Both books cover all aspects of BBC Basic but do not include assembly language programming or using the operating system commands – these will obviously be the subject of books to come.

The authors have produced 'self-teaching' texts, which start with 'basic' Basic, assuming no previous knowledge. The reader is expected to be sitting in front of a microcomputer while working through the book, and, as all Basics are different, it will need to be the BBC micro.

'Equipment every programmer would like – bug spray'

The differences between the books lie in their style of 'self-teaching' and emphasis.

Tim Hartnell's book is written in sections each covering one Basic keyword, or a group of related keywords. The problem is that *beginners are not* sure why they wish to learn about a particular keyword – until they learn Basic.

The reader gets an explanation of each keyword illustrated by several small programs which can be typed in and run. These include simple games and maths. Each is printed as a listing followed by, if possible, a copy of the results.

At this stage a few problems for the reader would have been useful, or even some suggestions on a program they could write using their new-found knowledge.

The last few sections are interesting in that they lead the reader into better things after spending many hours mastering Basic. The first covers writing draught-type board games and briefly explains the setting up of a draught board and making moves. There are then several programs, including draughts, Othello, mastermind, and a lunar lander.

The final section points the reader in the direction of writing better programs by 'structuring' and making them 'user-friendly' – a valuable chapter.

The second book by Neil and Pat Cryer, is in chapters each covering a particular topic, for example simple programming or loops.

Incidentally each chapter starts with a cartoon, including one showing a piece of equipment every programmer would like – a can of 'bug-spray'.

As with the Hartnell book, each chapter explains various Basic keywords using short programs as examples. Within each chapter there are several 'activities' to try. This usually means typing in a program and modifying it as shown in the book to see what happens. There is a discussion of the activities at the end of the chapter which explains what should happen and why. Since the main advantage of having a micro while learning Basic is that the reader can experiment, these provide a valuable starting point for such experimentation. At the end of each chapter various points are raised to help the reader sum up.

'Beginners are not sure why they want to learn a keyword'

Chapters on file handling and writing games programs are particularly interesting. These set out in detail the use of the sound features, graphics and how to animate your graphics.

The final book in this trio costs around £300 to £400 and comes with a free BBC Microcomputer, – the BBC *User Guide*, not the pre-release but the full version.

The introduction states that it is not a Basic programming course but a reference book for using the BBC microcomputer system and

Publishers should send review copies of books related to computing to the Editor, *Acorn User*, 53 Bedford Square, London WC1B 3DZ.

BBC Basic. However, the guide is written in three main sections, the first of which is for beginners.

The second section is an introduction to Basic programming. This 'self teaching' section starts by using Basic commands and goes on to programming, covering most of BBC Basic. Each statement is introduced and illustrated by several programs with some explanation. This part is as useful as an introduction to Basic.

The final, and by far the longest, part is a reference section and lists BBC Basic's keywords with an explanation of each. This is definitely not for the beginner – but necessary and useful. Also included is assembly language programming using the operating system, and technical information regarding the system.

As a *User Guide,* I found it useful in that it has everything to start the computer with plenty of system information, which is all the experienced user needs. It does not pretend to be an introduction to programming, but the second

'Problems for some teachers'

section could get most users off the ground to begin their long nights of programming.

The BBC micro is now appearing in many schools where it will be used, and maybe programmed, by teachers. However, without the many hours of use the keen hobbyist finds, teachers will find the user guide difficult to use.

This applies equally to the first two books. They will both teach the reader to program in Basic, but it takes a long time, and practice. This is because all these books teach Basic and leave it up to the reader to decide how to use the language. That again is fine for the hobbyist, but sometimes a micro user has a particular problem, and would like to solve it first and then write the Basic program using just those parts of the language which are necessary.

Perhaps what will be needed is a problem-oriented book on how to program, and then what parts of Basic to use.

Simon Dally reviews the enigma of Ultra

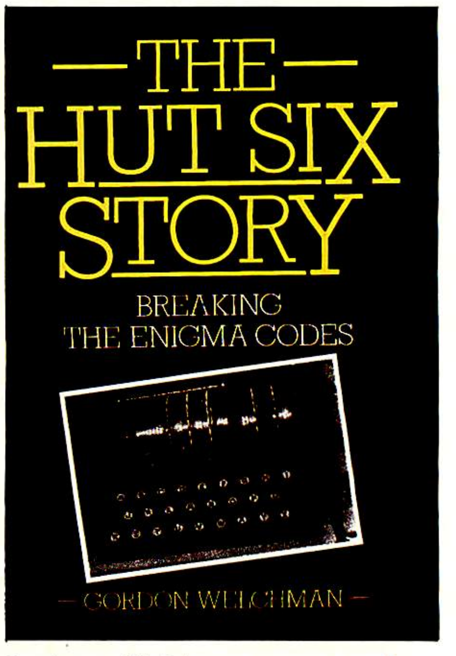
A lucky break

The Hut Six Story: Breaking the Enigma Codes, by Gordon Welshman, Allen Lane, £8.95.

Gordon Welchman is one of the few surviving members of Bletchley Park's 'team within a team' which cracked the codes of the Enigma cipher machine and generated its now famous output, Ultra.

Though many books have been written about 'BP' and Ultra, this is the first which gives a full, step-by-step explanation, in words which an interested layman can follow, of how the machine worked and the codes were broken.

As such, it provides invaluable long sought-after information. The material available on Ultra in the Public Record Office has been censored to remove technical information. Indirectly, the author puts forward a plausible reason for this. After the war, he tells us, the British sold Enigma machines to foreign governments on the grounds that the ciphers were unbreakable!



Gordon Welshman came from Cambridge to work with Ultra

This is not necessarily an example of a duplicitous sale of sub-standard goods. The author demonstrates convincingly that despite the breathtaking mathematical and organizational fire-power which the Allies – and the Poles before them – brought to bear on Enigma, the real weaknesses was not in the machine itself, but with the German operators.

Time and again the German mania for formal titles, and stereotyped messages at fixed times provided an entry point into the way the wheels were set for the day.

The Bletchley Park team in 'Hut Six' was indebted to one operator who invariably reported that he had nothing to report!

Mr Welchman also shows how one simple technical change to the plugs or 'steckers', would have put Hut Six virtually out of action. He ends a whole chapter on this theme with the sobering observation: 'We were lucky.'

The book is a brilliant addition to the literature on the Enigma machine. Part detective-story, part history, part mathematical theory, part character-study of the key participants at Hut Six, it should appeal to a wide range of computer hobbyists.

'One simple technical change would have put Hut Six virtually out of action'

Official Acorn Dealer List in the UK

Acorn dealers stock and service the Atom computer, Acorn systems and Acornsoft software. Many also offer service facilities for the BBC micro and these are marked with an asterisk. The Acorn dealer not only sells computers and peripherals but provides vital customer support. Most have recently attended technical seminars in Cambridge to ensure that they deal effectively with customers' enquiries. In addition, Acorn supply dealers with specific test and diagnostic equipment to speed fault finding.

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*Group 70 E18
01-505 7724
*Micro Store SW3
01-352 9291
*Off Records SW11
01-223 7730
Paul Electrical SW20
01-542 6546
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01-368 0572
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01-240 3386/7
RA Bailey Ltd SE26
01-693 1818
*Technomatic Ltd NW10
01-723 0233
The Video Palace W8
01-937 8587

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021-382 0185
Typewriter Centre (Head Office)B5
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021-455 9111
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*Control Universal Cambridge
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Gamer Brighton
0273-698424
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*Cardigan Electronics Cardigan
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K B Computers Wrexham
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SIR Computers Cardiff
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0382 2436/7

NORTHERN IRELAND
*C E M Microcomputer Services Belfast
0232 44111/43564

CHANNEL ISLANDS
*Channel Data Processing (Jersey) St Helier
0534-24333/72897

ISLE OF MAN
*Typestyle Ltd Onchan
0624-25890/24650

ISLE OF WIGHT
Excell Bembridge
098 387 2578

Let the machine speak for itself

Sir, As an owner of a BBC model 'B' micro I have, like many others, been outraged at the claims that have been made by Sinclair and his friends in the publishing trade about the Spectrum. It was to be expected that *Acorn User* would publish some sort of statement attacking Sinclair's claims. However, I had hoped that Acorn would not sink to Sinclair's level in making claims or statements which are not true.

It seems to me ridiculous that both Hauser and Beverley should argue that the BBC model 'A' can go up to 96k when a second processor is added. The Sinclair ads, showing a direct comparison between a model 'A' and Spectrum were correct to assert that the model 'A' had 32k maximum RAM. This figure is correct and in any event to talk of a second processor implies that the model 'A' has the Tube – it does not. There is no doubt in my mind that for the cost of upgrading to a model B and purchasing a second processor (effectively another micro) the user could find a firm prepared to modify his Spectrum so it too had 96k.

The other allegations made against Sinclair are undoubtedly true – but do you have to resort to sensational headline like 'The kids can use the Spectrum – I shall work with the Beeb' (not what Paul Beverley really said in his text). Sinclair owners must have guffawed out loud when they found out that the result of these libelous claims was that Hauser 'was considering taking the matter up with the Advertising Standards Authority' – is he really that unsure of his facts?

No, let the machine speak for itself and do not resort to the cheap jibes that Sinclair seems so fond of.

That aside, I very much enjoyed your second issue. In particular I enjoyed Joe Telford's article (very enlightening) and also that by Andy Hopper (I'm a systems programmer and know nothing of hardware but found his article readable and enlightening). No doubt people will tell me I'm missing the point when I say that I learnt nothing about the BBC micro when reading Brian Reffin Smith's irrelevant article on art!

One small point: I have been trying the 'Code-breakers' on page 56 and there is definitely a mistaake in the first one. Line 4 'X JEV' should be one word 'XJEV' (five) and the third word on line 3 should read 'UJSVKGIVOL' (widespread) and not 'UJSVKGIJEV' (widesprive!) Since there were mistakes in this 'easy' code-breaker, I have not dared to attempt the 'difficult' one.

Ian Smith
Eastleigh
Hants

You may rest assured that Hermann Hauser is certain of his facts, but when *Acorn User* went to press, it was not clear what had happened at the ASA. In fact, many of Acorn's complaints had already been made by other people. This is what Hauser was uncertain of.

Paul Beverley's quote was an accurate paraphrasing of what he said – and taken in context with the rest of the article it is not sensational, merely a conclusion.

You are right that the BBC machine can speak for itself – but the voice synthesis is not widely available yet.

As for your final point on the 'Codebreakers' – the November issue of *Acorn User* will answer that!

To err is human

Sir, I enjoyed the new magazine very much, and was particularly pleased to see a listing enabling me to use my BBC micro as a dumb terminal. But dare I try it? On page 25 you show a very nice program demonstrating all modes and colours and an error trap, and the author notes that there are no errors in the program. I have found three:

line 160 – reads P> instead of P.
line 100 – last variable should be X + 128, not Y
line 139 – needs a third NEXT (to match the FORs in lines 30, 50 and 60).

I can find simple errors and correct them in Basic programs, but not in machine code, so please try and avoid them!

More positively, I want to know how to connect my BBC micro to either a larger speaker or to an amplifier, to do more justice to the excellent sound facilities. Any ideas?

Douglas Weller
Birmingham

Yes, we admit it, you're right. Despite stringent checks on programs, these errors crept through. But, as Frank Spencer would say: 'Every day, in every way we're getting better and better.' (We hope.)

To connect a loudspeaker, use the existing plug under the keyboard and adjust the volume potentiometer to supply an enlarged unit.

Character spacings and hamfists

Sir, May I ask you to cast a little light on the following points about the BBC micro.

Whilst it is not difficult to work out how to drive characters one character position at a time, I cannot work out how to smooth out movement by moving in steps of ⅛th of a character (1 pixel position) at a time.

Letter O and number 0 are too close for my hamfist. I regularly lose my chance to run the OLD program by creating instead a one instruction program – 0 LD! Is mine a common problem: could the action not have been made illegal? Having got into the impasse is there anything I could do to get out?

How can I save typing and programming time by using my cassette to store useful PROC routines?

Trevor Butterworth
Warrington

If you want to print characters closer together than a character spacing you can do so in the following way. Select a screen mode other than mode 7, for example mode 5. Type the command VDU5. Use the move command to move to a particular location on the screen and then use the print command to print the character. Then use the move command to move to another location and again use print to print characters.

The command VDU5 causes all printed output to be positioned where the graphics cursor is on the screen. The graphics cursor can be positioned much more finely than the text cursor and as a result one can print characters very close to each other or indeed overlapping each other.

The keyboard layout is, as I am sure you realise, standard and I think that it would have been imprudent to have changed that. However, I do accept your point about loosing programs. The only advice I can give you is take care! The program is still in store but it is not easy to recover it. If you are interested I suggest that you examine the contents of memory beyond hexadecimal E100.

You will be able to determine the internal format used in storing programs and to see the first 10 or so bytes will have been corrupted.However, unless you are familiar with the use of indirection operators I suggest you leave it alone.

It is possible to save procedures on cassette and then call them in as you want. The secret is to save the individual procedures in ASCII format instead of internal format. If a procedure is saved in ASCII you can load that single procedure in without loosing all other programs using the command *EXEC. The technique used is explained in chapter 37 of the new *User Guide* on page 402.

Open the box?

Several readers have written in about upgrading their model As and making other alterations to the BBC micro.

You can do this without destroying the six-month guarantee, as long as the rest of the machine is left alone.

This assurance has come from Acorn so take care when you make alterations and ensure the additional parts are as recommended by the company, or dealers.

New MOS – is it free?

Sir, With regard to the new 1.0 machine operating system, can those of us with the 0.1 version expect to have it replaced free of charge under guarantee?

Also, on my board (model A) there is a space marked D9, but no diode there. Is this correct?

Colin Farquhar
Aberdeen

The first answer is no, although it is replaced free for disk and Econet upgrades.

The second answer is yes, it is correct. There is no diode fitted there.

Cassette fix

Sir, I read with interest the letters from your correspondent Ronald Alpiar in October's *Acorn User.*

I had similar problems in retrieving programs from cassette. I telephoned the BBC and Acorn and was unable to get a satisfactory answer. I tried four different tape recorders with no success.

Finally I contacted a friend who was using an Acorn Atom.

He had no problems using a Boots Audio Recorder Model CR325. I purchased one (about £23) and found it solved the problem. I now get 100% readback and lose no programs.

Peter White
Coulsdon, Surrey

Cassettes do vary from make to make and even sometimes between individual machines. As a general rule, keep the volume and tone high.

Disc upgrades

Sir, I have a BBC model A which is being upgraded to a model B. Do you have to use a BBC disk drive with this and do you need a disc controller?.

Mr Gunawardena
London

You can use various makes of disc drives with the BBC machine, but the machine must be modified to include the disc interface. The modification should be carried out by a dealer.

Workshops and talks in Norwich

Norwich and District BBC Microcomputer User Group (N & DBBCMUG for short?!) meets twice a month in Room A22 of Norwich City College. On the second Tuesday during term-time there is a workshop – bring your own hardware – which is usually followed by a short talk. On the fourth Tuesday demonstrations are given by invited speakers.

Meetings this autumn include:
12 October: workshop and introduction to machine code including demonstrations of Peeko-Computer – machine code simulation program.
October 26: starting to use the assembler on the BBC micro.
November 9: workshop, more on assembly language and practical exercises.
November 23: talk – Any suggestions? Any offers?
December 14: workshop including use of word processing packages.

Membership costs £3. Details from Paul Beverley, Electronics and Electrical Engineering Dept., Norwich City College, Ipswich Rd, Norwich NR2 2LJ. Tel (0603) 60011, ext. 233.

And yet more . .

■**Fareham and Portchester Amateur Computer Club** was established in 1980 and has now organised a referral service and users group for the BBC microcomputer. The group meets at 7 pm on the third Monday of each month at the Porchester Community Centre. For details contact: Peter Smith, 23 Sandy Close, Petersfield, Hants. Tel: Petersfield 4059 (evenings).

■The **Amateur Computer Club** is not tied to any particular machine, but acts as a co-ordinating body for regional user groups. It publishes a magazine — *Accumulator* — six times a year and holds regular meetings and exhibitions. Membership and details from Rupert Steele, St John's College, Oxford, OX1 3JP.

■**Harrow Computer Group** meets on alternate Wednesdays at 7pm in room G43 in Harrow College of Higher Education, or when closed, in 'The Plough', Kenton Rd. Details can be confirmed on 01-950 7068. Information from N.P. (Bazyle) Butcher, 16 St Peter's Close, Bushey Heath, Watford WD2 3LG.

Anybody else out there? Contact Acorn User, 53 Bedford Square, London WC1

CLUB CONTACTS

- Mr J. Ashurst
  Acorn Computer Users Group
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  Crescent Road
  Manchester 8
- Mr P. Beverley
  Norwich Area Acorn User Group
  Room 12a, Norwich City College
  Ipswich Road
  Norwich NR2 2LJ
- Mr B. Carroll
  The Cottage, 42 Manor Road
  Aldershot GU11 3DG
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  National BBC User Group
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- Mr P. Frost
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  London N7 8DB
- Mr T.G. Meredith
  Acorn Atom User Group
  Sheerwater,
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  Manchester Atom Users' Group
  3 Leopold Avenue
  Withington
  Manchester M20 8JG
- Mr R. Luff
  Kingbee
  54 Arlington Close
  Kingswinford
  West Midlands
- Steve White
  Atom/BBC User Group
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  Fareham and Portchester Amateur Computer Club
  23 Sandy Close
  Petersfield
  Hants.

Waiting for micro

Mrs Ronnie Rowsell tells of her fate in the Diary of a Computer Widow

I am a computer widow – second fiddle in my home and husband's affection to a 3-week-old, night-feeding BBC microcomputer.

It arrived overdue, just as my husband was nearing the brink of nervous collapse.

Every morning he would phone from work to see if the postman had brought the precious parcel. And if not, why not?

Once he insisted I ask the postman the next time that I saw him. I felt rather silly, asking the postman if he'd seen a parcel addressed to my husband, about so big by so big, hanging around anywhere?

Friends down south had all received theirs – why not us?

Things went from bad to worse. It got to the point where my husband was asking the children if mummy had hidden the parcel until he had finished doing the painting, long overdue, on the outside of the house, or caught up with reading his Open University units.

But such thoughts were never further from my mind. I was more anxious about the arrival of this computer than the rest of the nation had been about the arrival of the Royal baby. I felt the family were taking sides, as often I heard them planning how they would open it while I was watching Coronation Street with the cat!

Well, on the last Monday in June, the first twinge came when the doorbell rang as we were finishing our breakfast. My husband had forced down two Wheat-a-bix, and a cup of coffee. No one moved. All eyes were on him, the expectant father.

When the bell rang for the second time, confirming that no one was hearing things, I found myself alone, deserted.

It was a parcel. And it was carried ceremoniously into the dining room, where layer upon layer of packing was carefully shed. I couldn't bear to look, and was just about to rise from the table when a terrible thing happened.

It wasn't the computer at all, but a mere cassette recorder. He couldn't speak. I could see his mouth moving, but nothing was coming out. The children were speechless too, and I did not speak for fear of getting the damn thing rammed down my throat.

The only one who dared make a noise was the starving cat, neglected by the parcel. I thought a coronary would surely follow, but no, my husband's self-control was unbelievable. He drove to work shortly afterwards and did not crash the car once.

About a week later, the long-awaited event happened, and I handed over to an anxious man his brand new BBC microcomputer. He smiled in anticipation then proceded to tear upon the parcel with the strength and enthusiasm of the Incredible Hulk.

The children were eager to catch a glimpse of the almost legendary box that was to take their daddy away from them.

I tried to get into the mood for pressing buttons for the rest of the evening, by requesting *Space Invaders* to be typed in first. But I didn't realise it had to be worked out first then typed in taking some four weeks difficult work, the expert told me.

Everyone except me adjourned to the lounge armed with plugs, leads and wires, and I was left in peace to wash up. Then I peeped in to see what was going on. My husband had his head in his hands, and looked very upset.

In a wifely way, I asked: 'What's the matter pet?' He replied: 'The coloured television has broken down.'

I suggested he used the black and white set in the children's nursery – but honest pet! I wasn't making fun. I didn't realise it was a brand new BBC *colour* micro-computer you'd bought!

But I have learned a very valuable lesson from this exercise. As well as fetching his computer magazines and paying for them I am going to read them as well!

▶ *continued from page 38*

have extended this to 96 to include lower case. It could be extended further to produce user-defined graphics provided you can spare the memory for 96 characters. This needs 768 bytes and leaves a 12k Atom with only 3¾k.

The other facility provided by this program is high resolution graphics dumps. Using the subroutines explained earlier this is a fairly simple task. The screen memory for graphics mode 4 is arranged as 192 lines of 32 bytes. The routine at LL34 scans this and at the start of each line it calls LL2 to wait for a margin before sending the 32 individual bytes to the print byte routine. This is repeated until all 192 lines have been printed. Printing out other graphics modes is possible but mode 4 is the most suitable because both it and the printer have a horizontal resolution of 256 dots.

The printer controller is given in program 1. It is written entirely in machine code and on an Atom with 5k of textspace it should be assembled at 3780 leaving ¾k for the character set definitions. If you have an Atom with a different amount of memory you can relocate the program by changing the address in line 30. In case you need it again, save the program after you have run it and load program 2. This is to accept the character set data in program 3 and put the table at #3900 to #3BFF. To use it, just type in the hex digits exactly as given. The Atom will add all the spaces and move on to the next line when required so you won't ever need to press return. If you make a mistake just press 'M' to delete the last digit or byte and then retype it. When all 768 bytes have been entered it will automatically check the table by totalling the bytes and comparing the result with 181778. If it's wrong you'll have to find the error by printing out the character set.

Save the whole program with

```
#SAVE "PRINTER"3780 3BFF
```

Now whenever you want to use the printer, load the program with

```
#RUN"PRINTER"
```

This loads the printer then links to #3780 initialising the new printer routine. Control B (or $2) will now enable the printer and control C (or $3) will disable it. Try

```
P.$2"This is an example"$3
```

to test it. Note that the lower case is actually printed in lower case and not inverse as it is on the screen. Also, it is still printed on the screen. If you don't want this, use the VDU control codes to turn off the screen. If you want to list a program just to the printer type

```
P.$21$2
P.$6$3
```

to return it to normal when it has finished. Remember that if you ever have to press break after loading the new printer routine type LINK#3780 to initialise it again.

Graphics mode 4 dumps can be achieved by LINK #38A3 for black on white outputs or LINK#38A8 for white on black outputs.

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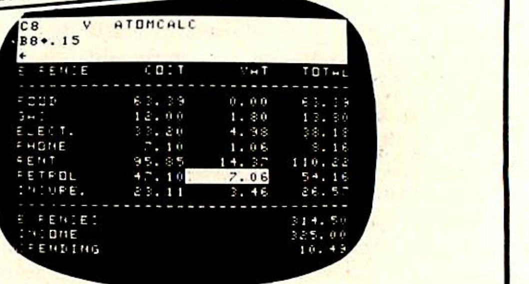

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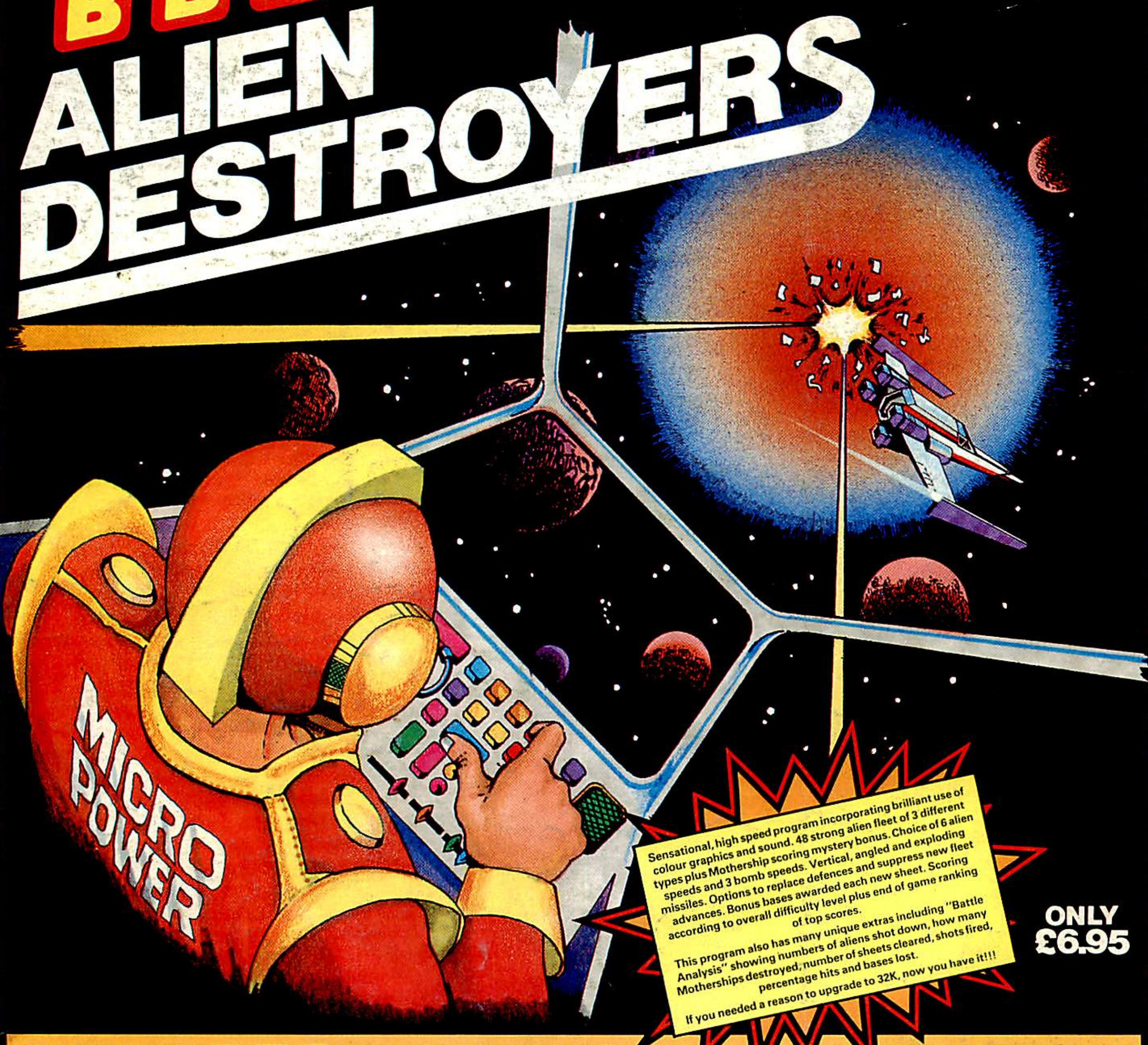

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